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## UNITED STATES DEPARTMENT OF THE INTERIOR

## GEOLOGICAL SURVEY

**DRAFT**

GEOCHEMICAL ASSESSMENT OF MINERAL RESOURCES IN THE GOSHUTE CANYON  
SURVEY AREA (NV 040-015), EAST-CENTRAL NEVADA

By

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and Christopher Goodhue

*Open-file report 84-101*

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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## ABSTRACT

A stream-sediment geochemical survey of the Goshute Canyon Resource Survey Area (NV 040-015), was conducted as part of the Bureau of Land Management Phase II mineral resource evaluation. During the summer of 1983, stream-sediment samples were collected from 45 first-order drainage basins within the survey area. The minus-80-mesh fraction of the stream-sediment samples and the nonmagnetic fraction of panned concentrate stream-sediment samples were analyzed. Anomalous concentrations for the elements Ag, Au, Cu, Pb, Sn, W, and Zn were identified in the panned concentrate samples. The geochemical analyses and the geological setting and structure suggest that undiscovered base- and precious-metal mineral deposits may be present in the area. A comparison of the geochemical characteristics and geologic setting of the known mineral deposits in the Cherry Creek mining district, south of the survey area, suggests that the identified trace-element suite found within the survey area may be genetically related to a hidden porphyry-type mineral deposit.

## INTRODUCTION

The Goshute Canyon Bureau of Land Management Resource Survey Area (NV 040-015) is located approximately 53 miles north of Ely, Nevada, within the central portion of the Cherry Creek Range (figure 1), and covers 31,343 acres. The town of Cherry Creek is located near the southern boundary of the area.

The survey area is a northeast-trending Basin and Range fault block consisting predominantly of west dipping Paleozoic marine sedimentary rocks. Early Tertiary monzonitic to quartz monzonitic igneous stocks have been intruded locally within, and in the vicinity, of the study area. Mid-Tertiary volcanic rocks occur locally to the west of the survey area. Extensive mining

## ABSTRACT

A stream-sediment geochemical survey of the Goshute Canyon Resource Survey Area (NW 040-012) was conducted as part of the Bureau of Land Management Phase II mineral resource evaluation. During the summer of 1981, stream-sediment samples were collected from 45 first-order drainage basins within the survey area. The minus-60 mesh fraction of the stream-sediment samples and the nonmagnetic fraction of ground concentrate stream-sediment samples were analyzed. Anomalous concentrations for the elements As, Au, Cu, Pb, Zn, W, and In were identified in the ground concentrate samples. The geochemical analyses and the geological setting and structure suggest that undiscovered base- and precious-metal mineral deposits may be present in the area. A comparison of the geochemical characteristics and geologic setting of the known mineral deposits in the Cherry Creek Mining District, south of the survey area, suggests that the identified trace-element suite found within the survey area may be genetically related to a hidden porphyry-type mineral deposit.

## INTRODUCTION

The Goshute Canyon Bureau of Land Management Resource Survey Area (NW 040-012) is located approximately 55 miles north of Tye, Nevada, within the central portion of the Cherry Creek Range (Figure 1), and covers 31,363 acres. The town of Cherry Creek is located near the southern boundary of the area.

The survey area is a northeast-trending basin and range fault block consisting primarily of west dipping Paleozoic marine sedimentary rocks. Early Tertiary granitic to quartz monzonitic igneous intrusions have been intruded locally within, and in the vicinity, of the study area. Mid-Tertiary volcanic rocks occur locally to the west of the survey area. Extensive mining



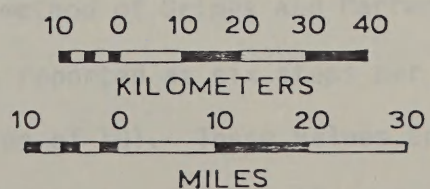
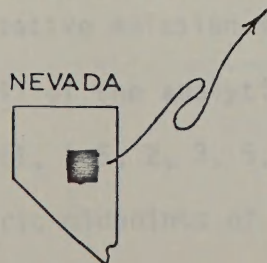
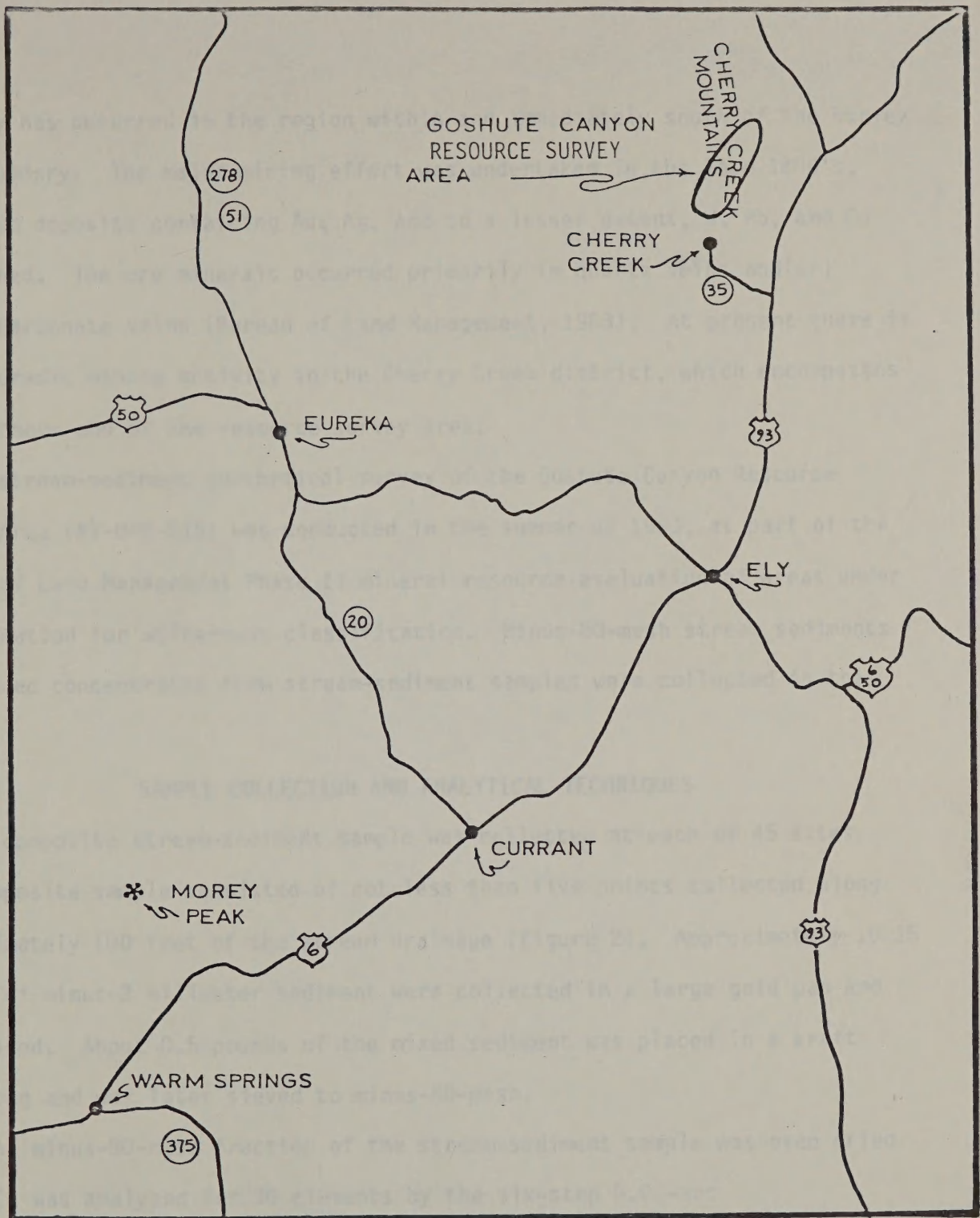


Figure 1.--Index map of the Goshute Canyon Resource Survey Area, east-central Nevada.

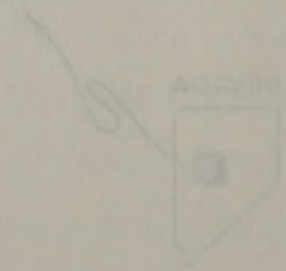
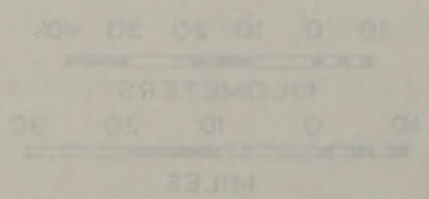
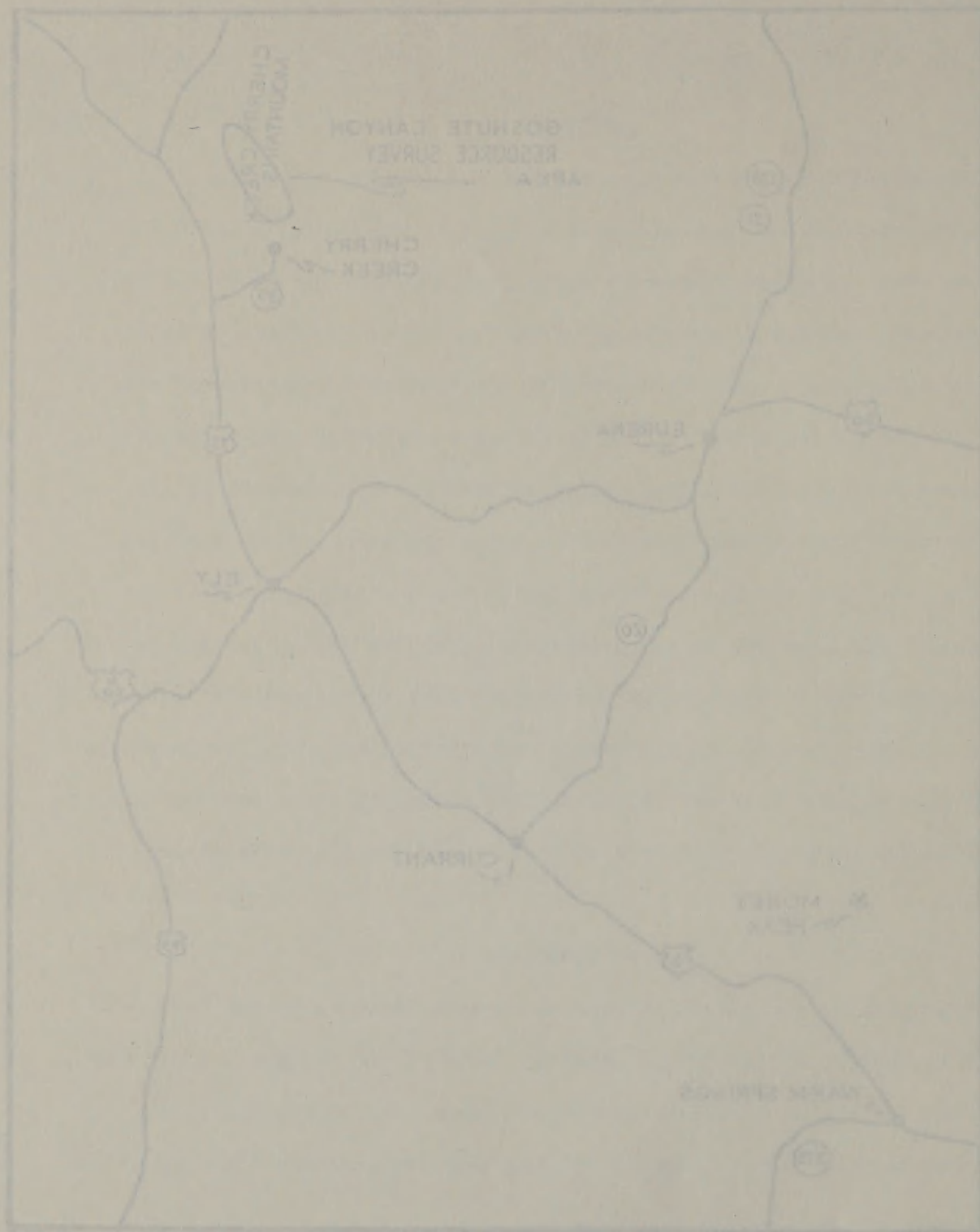


Figure 1--Index map of the Spahute Canyon Resource Survey Area, east-central Nevada.

activity has occurred in the region within and immediately south of the survey area boundary. The major mining effort was undertaken in the late 1800's, when rich deposits containing Au, Ag, and to a lesser extent, W, Pb, and Cu were mined. The ore minerals occurred primarily in quartz veins and(or) quartz-carbonate veins (Bureau of Land Management, 1983). At present there is only sporadic mining activity in the Cherry Creek district, which encompasses the southern end of the resource survey area.

A stream-sediment geochemical survey of the Goshute Canyon Resource Survey Area (NV-040-015) was conducted in the summer of 1983, as part of the Bureau of Land Management Phase II mineral resource evaluation of areas under consideration for wilderness classification. Minus-80-mesh stream sediments and panned concentrates from stream-sediment samples were collected in this survey.

#### **SAMPLE COLLECTION AND ANALYTICAL TECHNIQUES**

A composite stream-sediment sample was collected at each of 45 sites. The composite sample consisted of not less than five points collected along approximately 100 feet of the stream drainage (figure 2). Approximately 10-15 pounds of minus-2 millimeter sediment were collected in a large gold pan and hand mixed. About 0.5 pounds of the mixed sediment was placed in a kraft paper bag and was later sieved to minus-80-mesh.

The minus-80-mesh fraction of the stream-sediment sample was oven dried at 90°C, was analyzed for 30 elements by the six-step D.C.-arc semiquantitative emission spectrographic method of Grimes and Marranzino (1968). All of the analytical values are reported as six steps per order of magnitude (1, 1.5, 2, 3, 5, 7, or multiples of 10). These values approximate the geometric midpoints of successive concentration ranges (Grimes and Marranzino, 1968). This analytical method utilizes a series of elemental



activity has occurred in the region within and immediately south of the survey area. The major mining effort was undertaken in the late 1800's, when rich deposits containing Au, Ag, and Cu, and to a lesser extent, Pb, Zn, and Cu were mined. The ore minerals occurred primarily in quartz veins and/or quartz-carbonate veins (Bureau of Land Management, 1983). At present there is only sporadic mining activity in the Cherry Creek district, which encompasses the southern end of the resource survey area.

A stream-sediment geochemical survey of the Anasazi Canyon Resource Survey Area (NV-040-015) was conducted in the summer of 1981, as part of the Bureau of Land Management Phase II mineral resource evaluation of areas under consideration for wilderness classification. Minus-80-mesh stream sediments and panmed concentrates from stream-sediment samples were collected in this survey.

#### SAMPLE COLLECTION AND ANALYTICAL TECHNIQUES

A composite stream-sediment sample was collected at each of 45 sites. The composite sample consisted of not less than five panmeds collected along approximately 100 feet of the stream drainage (Figure 2). Approximately 10-15 pounds of minus-50-mesh stream sediment were collected in a large galvanized steel bucket. About 0.5 pounds of the mixed sediment was placed in a kraft paper bag and was later stored in minus-80-mesh.

The minus-80-mesh fraction of the stream-sediment sample was oven dried at 80°C, and analyzed for 30 elements by the six-step D.C.-AAS sequential extraction method of Brinen and Martinovic (1982). All of the analytical values are reported as six steps per order of magnitude (1, 1.5, 2, 3, 5, 7, or multiples of 10). These values approximate the geometric midpoint of successive concentration ranges (Brinen and Martinovic, 1982). This analytical method utilizes a series of elemental

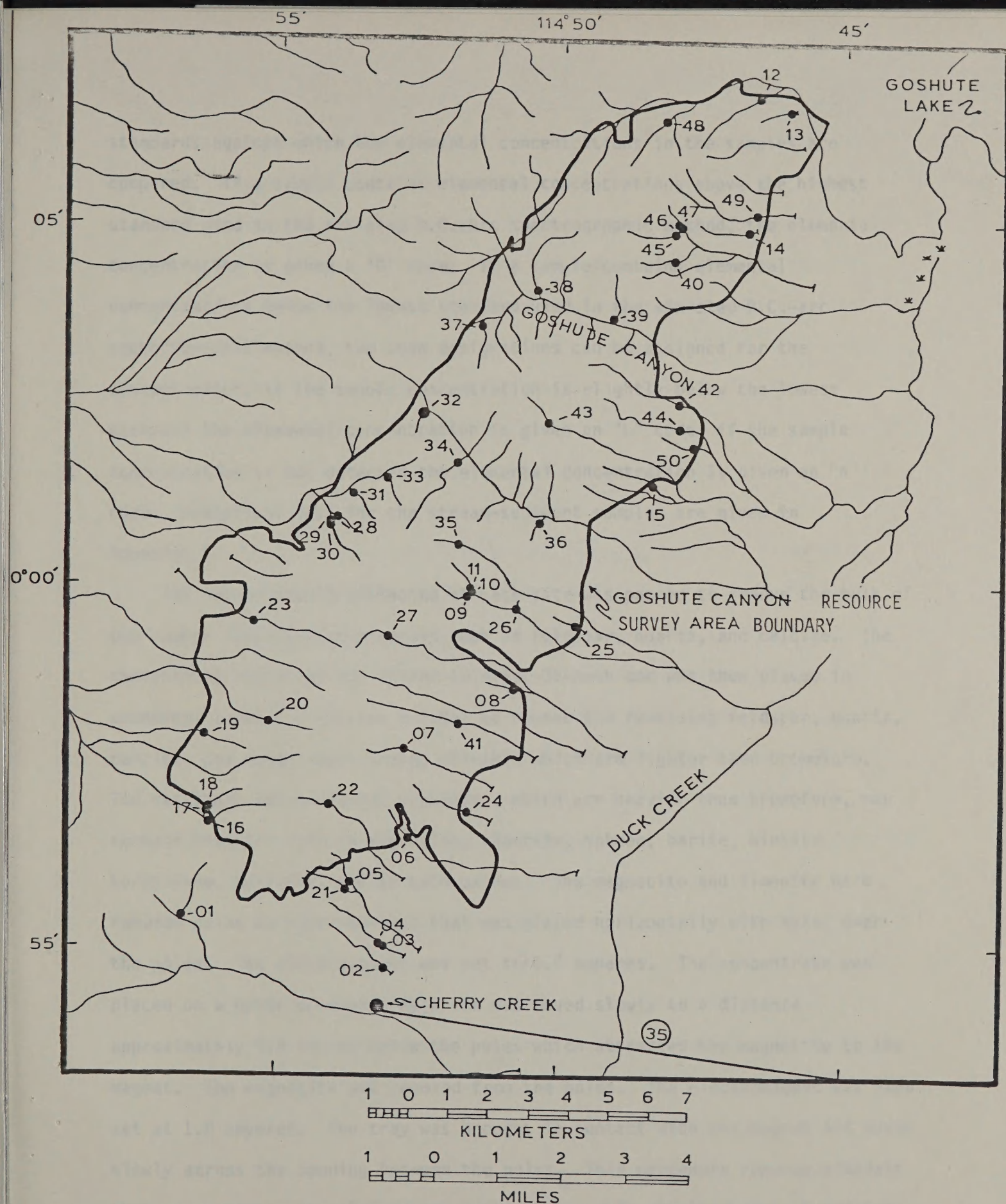
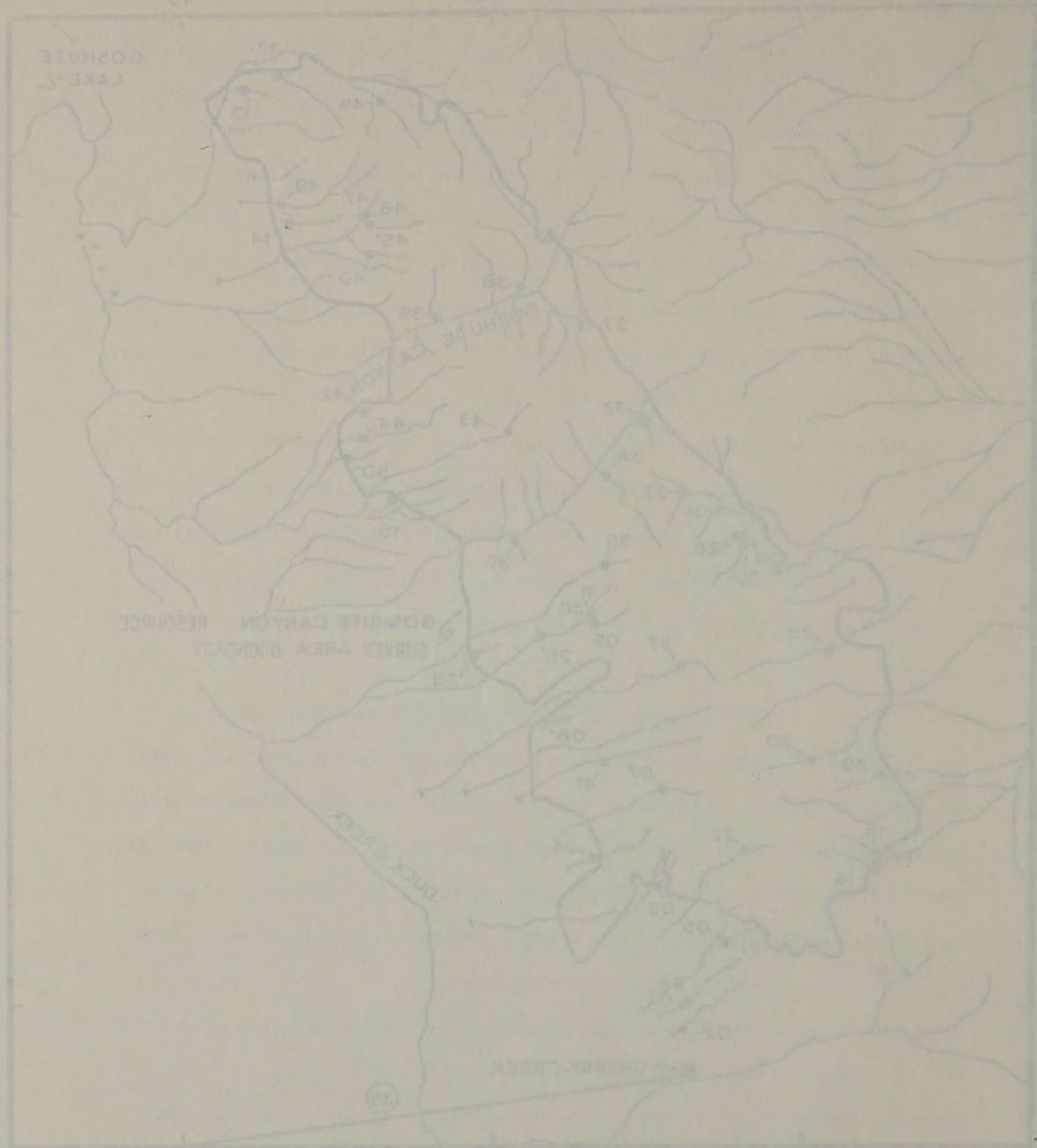


Figure 2.--Sampling locations in the Goshute Canyon Resource Survey Area, east-central Nevada.



0 1 2 3 4 5 6 7  
MILES  
0 1 2 3 4 5 6 7  
MILES

Figure 2--Staging locations in the Goshute Canyon Resource Survey Area, 1982-1983



standards against which the elemental concentrations in the samples are compared. If a sample contains elemental concentrations above the highest standard used in the six-step D.C.-arc spectrographic method, the elemental concentration is given a "G" code. If a sample contains elemental concentrations below the lowest standard used in the six-step D.C.-arc spectrographic method, two code designations can be assigned for the concentration; if the sample concentration is slightly below the lowest standard the elemental concentration is given an "L" code; if the sample concentration is not detected the elemental concentration is given an "N" code. Analytical data for the stream-sediment samples are given in Appendix 1.

The second sample collected at each site was panned to remove the bulk of the common rock-forming minerals such as feldspar, quartz, and calcite. The concentrate was dried and sieved to minus-35-mesh and was then placed in bromoform (specific gravity = 2.86) to remove the remaining feldspar, quartz, calcite, and other rock-forming minerals which are lighter than bromoform. The resultant heavy-mineral separates, which are heavier than bromoform, may contain minerals such as magnetite, ilmenite, sphene, barite, biotite, hornblende, sulfides, and certain oxides. The magnetite and ilmenite were removed using an electromagnet that was placed horizontally with mylar over the poles. The electromagnet was set to 0.4 amperes. The concentrate was placed on a mylar covered tray which was moved slowly to a distance approximately 4-6 inches below the poles which attracted the magnetite to the magnet. The magnetite was removed from the poles. The electromagnet was then set at 1.8 amperes. The tray was brought in contact with the magnet and moved slowly across the opening between the poles. This procedure removes minerals that are magnetic at a 0.6 ampere setting when a Frantz Isodynamic Separator

standards against which the elemental concentrations in the samples are compared. If a sample contains elemental concentrations above the highest standard used in the six-step D.C.-arc spectrographic method, the elemental concentration is given a "6" code. If a sample contains elemental concentrations below the lowest standard used in the six-step D.C.-arc spectrographic method, two code designations can be assigned for the concentration: if the sample concentration is slightly below the lowest standard the elemental concentration is given an "L" code; if the sample concentration is not detected the elemental concentration is given an "N" code. Analytical data for the stream-sediment samples are given in

#### Appendix I.

The second sample collected at each site was banded to remove the bulk of the common rock-forming minerals such as feldspar, quartz, and calcite. The concentrate was dried and ground to minus-35-mesh and was then placed in a bromoforn (specific gravity = 2.86) to remove the remaining feldspar, quartz, calcite, and other rock-forming minerals which are lighter than bromoforn. The resultant heavy-mineral separator, which are heavier than bromoforn, may contain minerals such as magnetite, ilmenite, sphene, barite, biotite, hornblende, sulfides, and certain oxides. The magnetite and ilmenite were removed using an electromagnet that was placed horizontally with water over the poles. The electromagnet was set to 0.4 amperes. The concentrate was placed on a nylon covered tray which was moved slowly to a distance approximately 0.5 inches below the poles which attracted the magnetite to the magnet. The magnetite was removed from the poles. The electromagnet was then set to 1.8 amperes. The tray was brought in contact with the magnet and moved slowly across the opening between the poles. This procedure removed minerals that are magnetic at 0.8 amperes setting up a Frantz Isodynamic Separator



is used as discussed in Flinter (1959), Hess (1956), and Nickel (1968, 1969) with 15° forward slope and 10° side slope. The mineral grains left on the tray were nonmagnetic at a 0.6 amperage. The varying magnetic susceptibility depends primarily on the degree of paramagnetism exhibited by the mineral, which reflects the amount of substitution into the crystal lattice by ions such as  $\text{Fe}^{2+}$  (McAndrew, 1957; Rosenblum, 1958; Hurlbut, 1971). The magnetic splits of the panned concentrates may contain minerals such as biotite, sphene, pyroxene, hornblende, and garnet. The nonmagnetic splits may contain minerals such as topaz, sphene, rutile, hematite, sulfides, and some sulfates, carbonates, and oxides.

Representative samples of the nonmagnetic split were pulverized in an agate crucible and analyzed by a modified version of the six-step D.C.-arc semiquantitative emission spectrographic method described by Grimes and Marranzino (1968). A modification of the method was necessary for the analysis of the nonmagnetic heavy-mineral concentrate samples to eliminate spectral interferences produced by matrix effects characteristic of this sample type. The effect of this modification was a loss of sensitivity resulting in an increase of all lower limits of determination by two reporting units. The six-step D.C.-arc emission spectrographic method provides reproducibility within one reporting unit of the reported value approximately 88 percent of the time and within two reporting units of the reported value approximately 96 percent of the time (Motooka and Grimes, 1976). The analytical results for the nonmagnetic fraction of the panned concentrates are given in Appendix 2.





## INTERPRETATION OF THE NONMAGNETIC FRACTION OF PANNED CONCENTRATES

The nonmagnetic fraction of the panned concentrate from the stream-sediment samples were valuable for determining geochemical characteristics of known mineralized areas and in assessing the mineral resource potential of the survey area. Known mineral deposits occur in the basins upstream from sites 02, 03, 04, 05, 06, 07, and 21 (figure 2). The concentrates from these basins contain anomalous concentrations of many ore and pathfinder elements (Appendix 2). The mineralized areas were characterized by anomalous concentrations of Pb, Sn, and W with Cu, Zn, Ag, Mo, and Au occurring at some sites. Elemental distribution in basins with mining activity was compared to distribution of the same elements in basins with no known mining activity.

The upwelling mineralizing fluids appear to have reacted with certain rock units and(or) were restricted to certain horizons or rock units in the Precambrian section, possibly due to impermeable shale units (Hose and Blake, 1976). Of particular note is site 22 where elevated concentrations of Ag, Pb, Sn, and W occur, and sites 27 and 31 where Ag and Au were detected. The rocks in these basins warrant further geochemical investigation. The distribution of elevated Ag and Au concentrations are shown in figure 3, Cu and Zn are shown in figure 4, Mo, Sn, and W are shown in figure 5 Pb is shown in figure 6, and Nb and Y are shown in figure 7.

The geologic evidence also suggests that the Cherry Creek district is underlain by a buried stock. A set of circular faults in sedimentary rocks of the Cherry Creek district is interpreted as reflecting the emplacement of a stock beneath the Cherry Creek district.

# INTERPRETATION OF THE MAGNETIC FRACTION

## OF PAIRED CONCENTRATES

The magnetic fraction of the paired concentrates from the  
x-ray-spectroscopic samples were valuable for determining geochemical  
characteristics of known mineralized areas and in assessing the mineral  
resources potential of the survey areas. Known mineral deposits occur in the  
basin systems from sites 02, 03, 04, 05, 06, 07, and 21 (Figure 2). The  
concentrates from these basins contain numerous concentrations of many ore  
and indicator elements (Appendix 2). The mineralized areas were  
characterized by anomalous concentrations of Pb, Zn, and W with Cu, In, Ag,  
Mo, and Au occurring at some sites. Elemental distribution in basins with  
mining activity was compared to distribution of the same element in basins  
with no known mining activity.

The sampling sites for fluid samples to have tested with certain  
rock units (and/or) were restricted to certain horizons or rock units in the  
Pocomoke section, possibly due to impermeable shale units (Hess and Blake,  
1958). Of particular note is site 22 where elevated concentrations of Ag, Pb,  
Zn, and W occur, and sites 23 and 24 where Ag and Au were detected. The rocks  
in these basins warrant further geochemical investigation. The distribution  
of elements Ag and Au concentrations are shown in Figure 3, Cu and In are  
shown in Figure 4, Mo, Zn, and W are shown in Figure 5 and V are shown in  
Figure 6, and Ni and V are shown in Figure 7.

The geologic evidence also suggests that the Cherry Creek district is  
underlain by a buried block. A set of circular faults in sedimentary rocks of  
the Cherry Creek district is interpreted as reflecting the emplacement of a  
block beneath the Cherry Creek district.



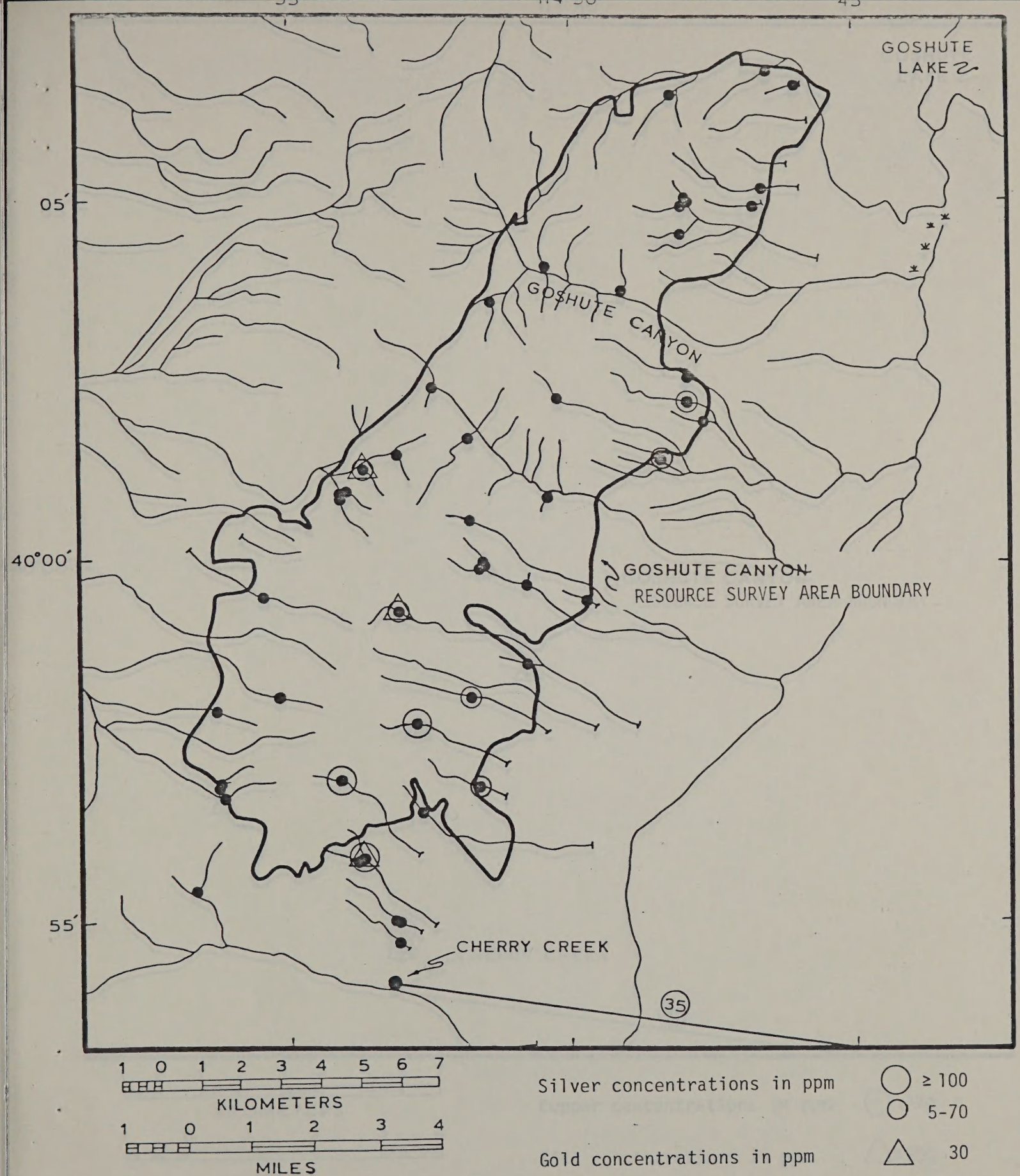


Figure 3.--Distribution of elevated silver and gold concentrations from the nonmagnetic fraction of the panned concentrate from the stream sediment samples in the Goshute Canyon Resource Survey Area, east-central Nevada.

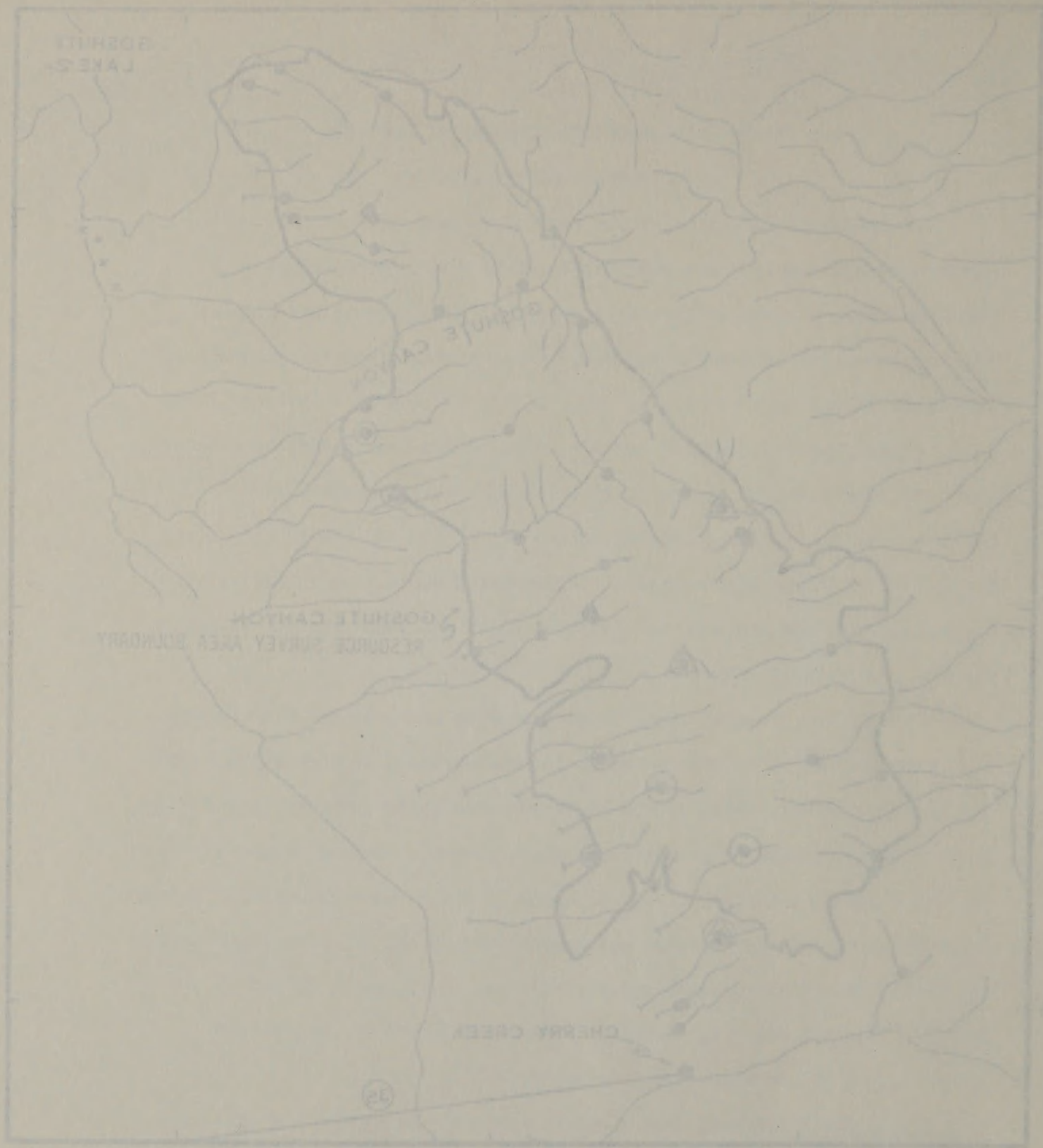


Figure 3.—Distribution of silver and gold concentrations from the nonmagmatic fraction of the ground concentrate from the stream sediment samples in the Goshute Lake Resource Survey Area, east-central Nevada.



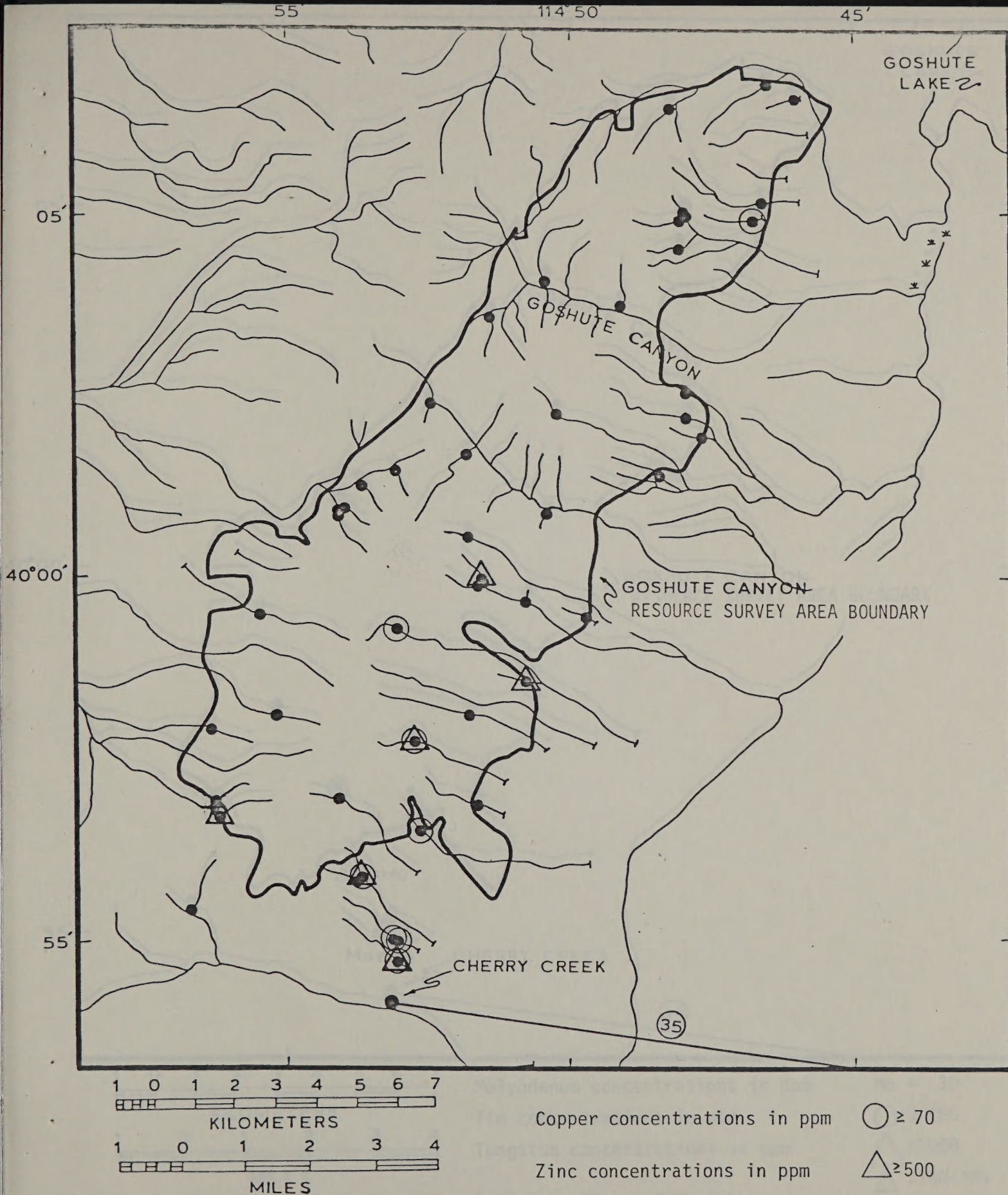


Figure 4.--Distribution of elevated copper and zinc concentrations from the nonmagnetic fraction of the panned concentrate from the stream sediment samples in the Goshute Canyon Resource Survey Area, east-central Nevada.





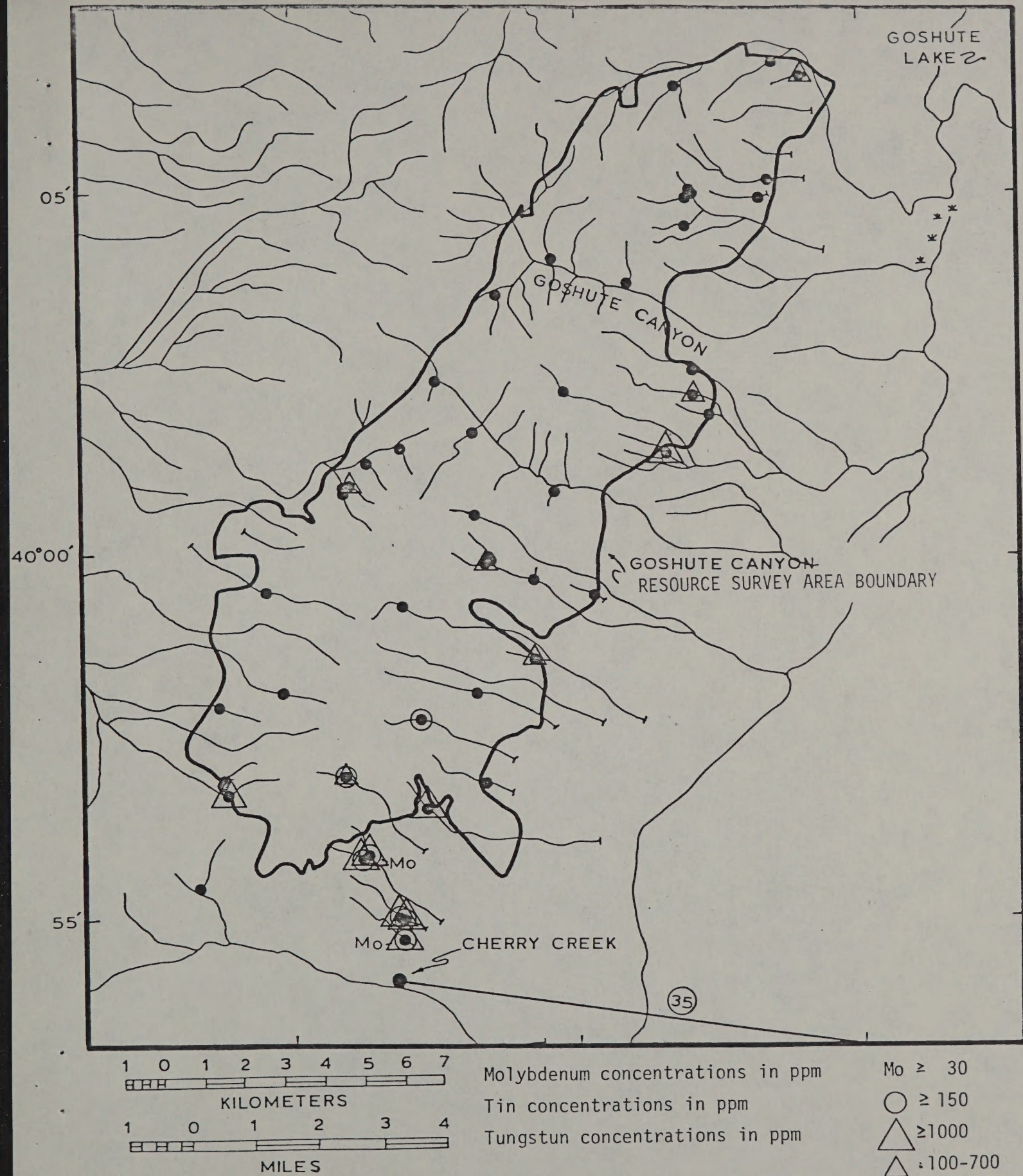


Figure 5.--Distribution of elevated molybdenum, tin, and tungsten concentrations from the nonmagnetic fraction of the panned concentrate from the stream sediment samples in the Goshute Canyon Resource Survey Area, east-central Nevada.



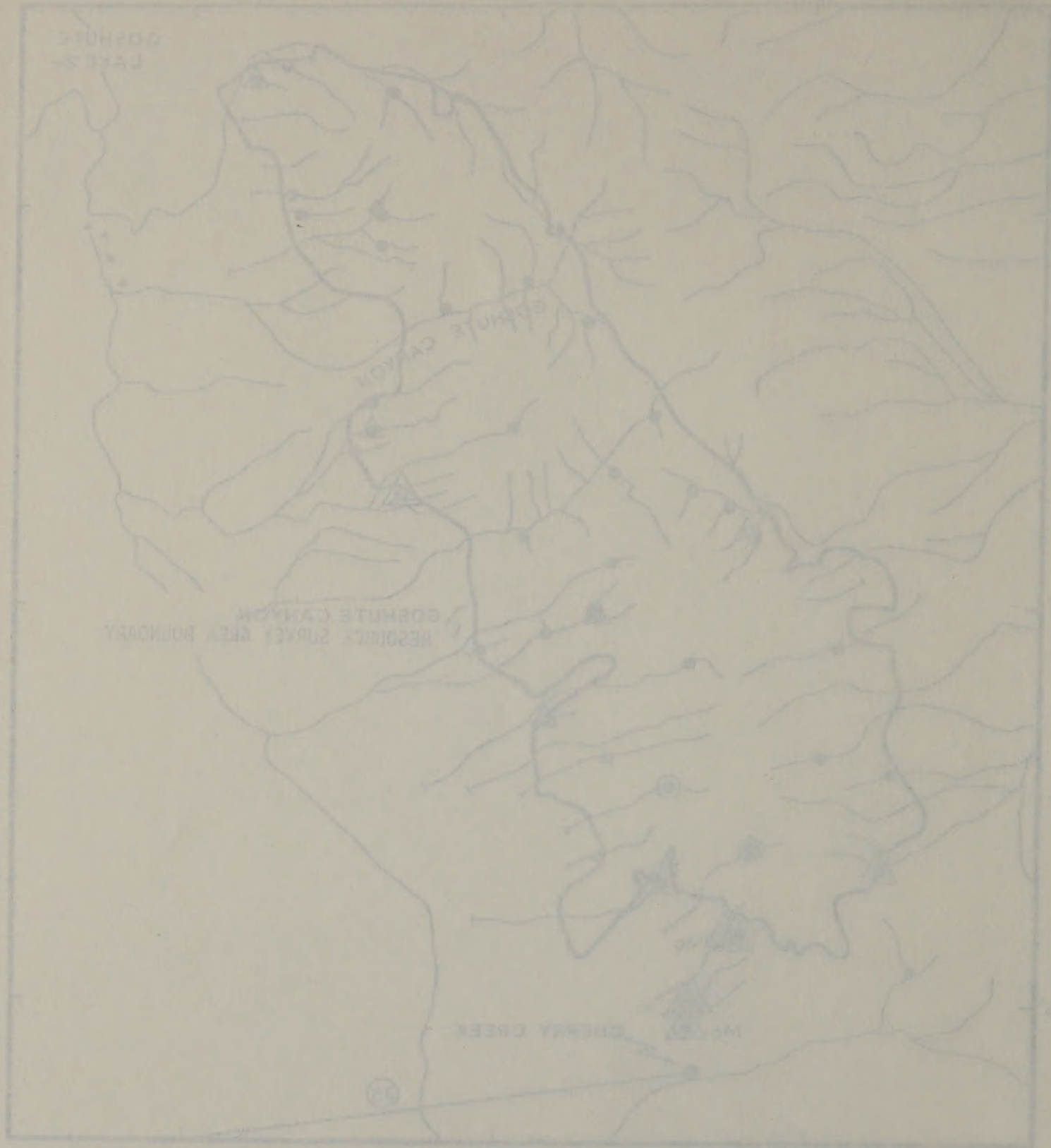


Figure 2--Distribution of lead, cadmium, and copper concentrations from the Goshute Canyon Survey Area, east-central Nevada. Concentrations are in ppm. The symbols used are: circle for lead, triangle for cadmium, and square for copper. The map shows the distribution of lead, cadmium, and copper concentrations in the Goshute Canyon area.



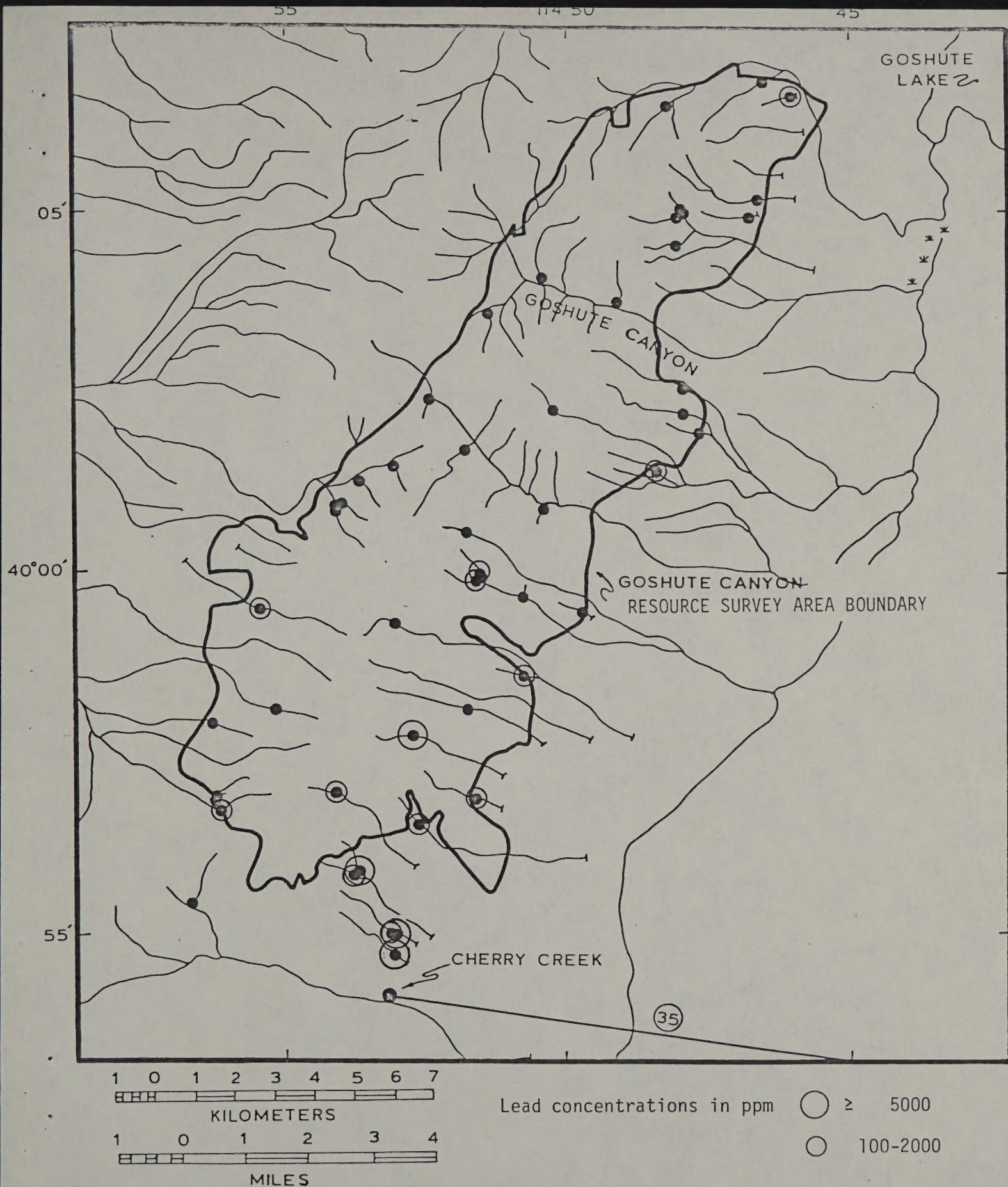


Figure 6.--Distribution of elevated lead concentrations from the nonmagnetic fraction of the panned concentrate from the stream sediment samples in the Goshute Canyon Resource Survey Area, east-central Nevada.

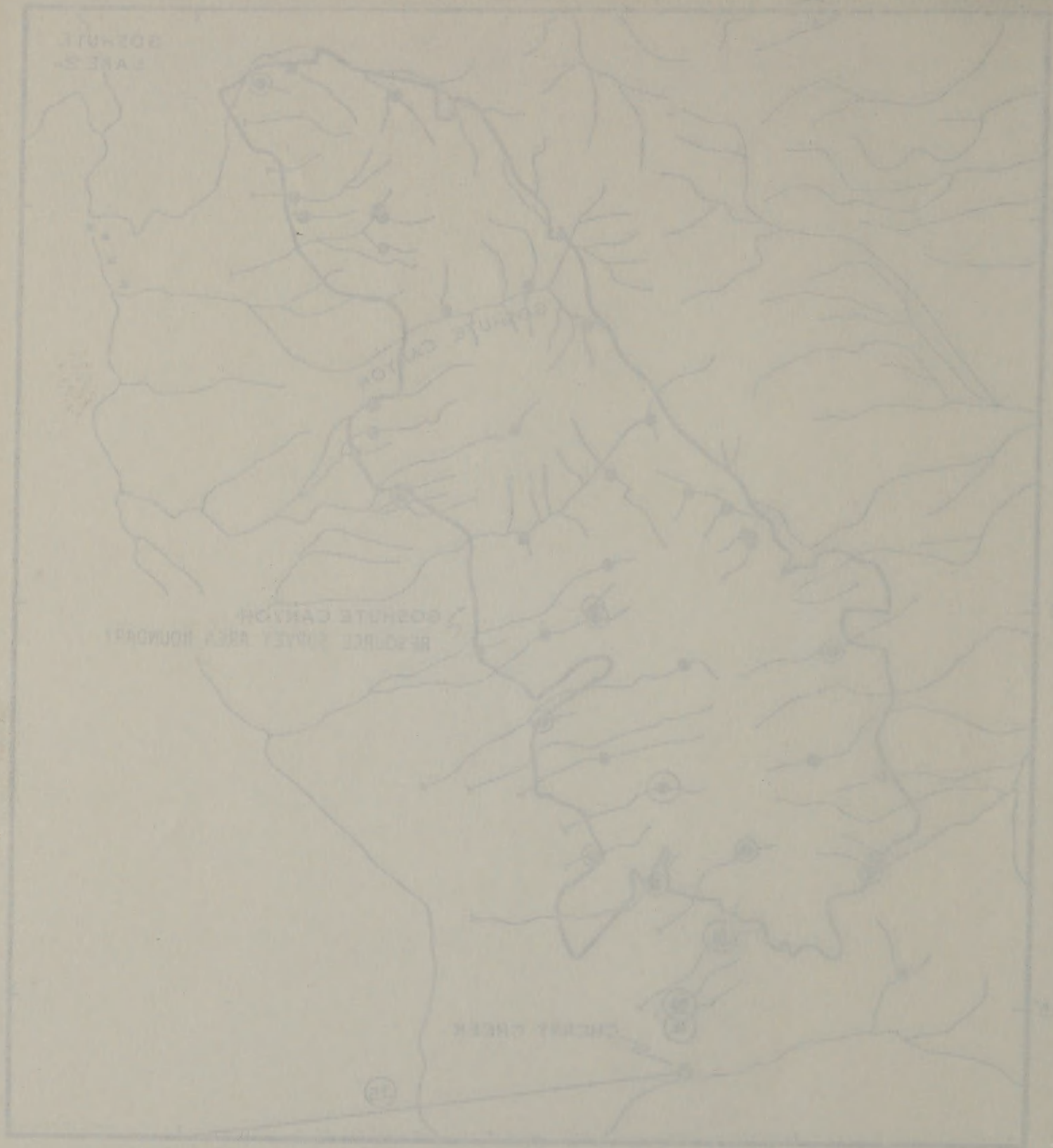


Figure 1. Distribution of elevated lead concentrations from the nonpoint source fraction of the ground water in the Goshute Canyon area, east-central Nevada.



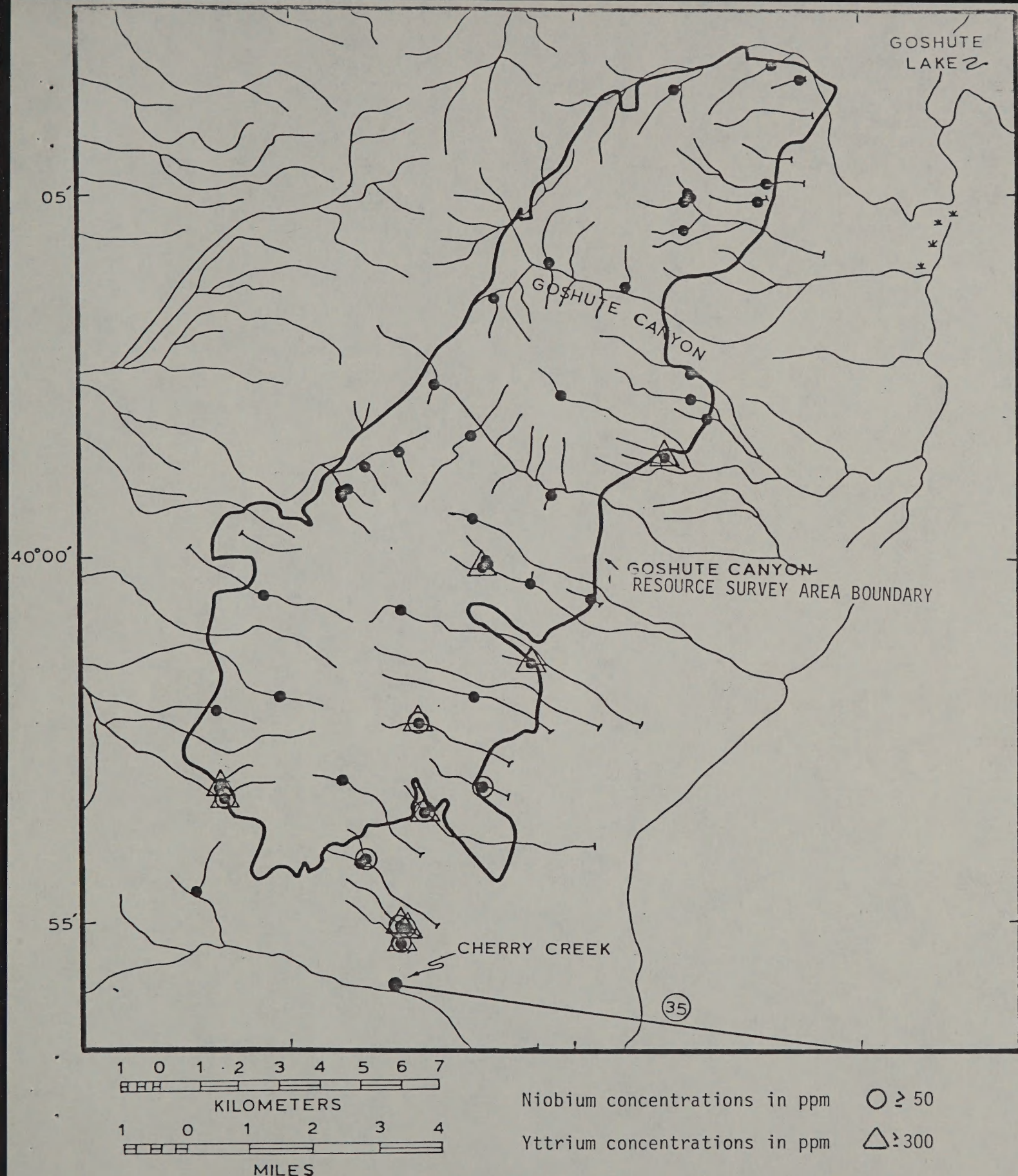


Figure 7.--Distribution of elevated niobium and yttrium concentrations from the nonmagnetic fraction of the panned concentrate from the stream sediment samples in the Goshute Canyon Resource Survey Area, east-central Nevada.





## GEOLOGY

The Goshute Canyon Resource Survey Area, located within the central portion of the Cherry Creek Range, is a fault block typical of the Basin and Range province. The southern portion of the Cherry Creek Range trends northeast then swings to the northwest near the Elko-White Pine county line. The rocks are predominantly Paleozoic marine sediments that have been locally intruded by Early Tertiary monzonitic to quartz monzonitic composition bodies.

Many portions of the survey area are very rugged, with steep cliffs and deep canyons. The elevation of several peaks exceed 10,000 feet. The western portion of the survey area drains into Butte Valley while the eastern portion drains into the Steptoe Valley.

A detailed description of the rock units, structural geology and tectonics, paleontology, and historical geology is presented in the G-E-M Resources Area report (U.S. Bureau of Land Management, 1983).

## ENERGY AND MINERAL RESOURCES

The Cherry Creek district is located near the town of Cherry Creek and extends into the southern boundary of the resource survey area. The district has produced Au and Ag, with lesser amounts of W, Cu, and Pb. The Gypsy silver-tungsten mine, the Black Metal gold-silver-base metal mine, the Chance silver-tungsten mine, the Exchequer and Fillmore gold-silver mines (Hose and others, 1976) all lie within or on the boundary of the survey area.

Small prospects occur north of the Cherry Creek district (Hose and others, 1976) and recent exploration surveys have occurred within and in the vicinity of the survey area. Jasperoid occurs in the central part of the survey area.

A detailed discussion of mining claims and mineral economics is found in the G-E-M Resources Area report for Goshute Canyon (U.S. Bureau of Land Management, 1983).

## SYNOPSIS

The Cherry Creek Resource Survey Area, located within the western portion of the Cherry Creek Range, is a fault block typical of the Basin and Range province. The southern portion of the Cherry Creek Range trends northeast then angles to the northwest near the Elko-Silver Lake county line. The rocks are predominantly Paleozoic marine sediments that have been locally metamorphosed by Early Tertiary magmatic to quartz monzonitic plutonism. The eastern portion of the survey area drains into Butler Valley while the western portion drains into the Hoback Valley.

A detailed description of the rock units, structure, geology and hydrology, paleontology, and historical geology is presented in the 6-2-M Resource Area Report (U.S. Bureau of Land Management, 1982).

## CHERRY CREEK MINERAL RESOURCES

The Cherry Creek district is located near the town of Cherry Creek and extends into the southern boundary of the resource survey area. This district has produced for many years its famous minerals of K, Ca, and Na. The district at present is mined for the black (Wax) gold-silver-base metal mine, the Chance silver-lead-zinc mine, the Fairmount and Elbowe-gold-silver mines (Koss and others, 1982) and its efforts to open the boundary of the survey area. Small prospects occur north of the Cherry Creek district (Koss and others, 1982) and recent evaluation surveys have occurred at the end of the boundary of the survey area. Additional surveys in the eastern part of the survey area.

A detailed discussion of mineral claims and mineral resources is found in the 6-2-M Resource Area Report (U.S. Bureau of Land Management, 1982).



Precious metals and precious metal containing base-metal sulfide mineral deposits are found in nearly all rock types exposed in the Cherry Creek district. Four stratigraphic horizons in Cambrian formations are the most favorable hosts for mineralization (Hose and others, 1976). Gold-quartz veins occur only where quartzite of the Prospect Mountain Formation forms at least one wall. Quartz or quartz-calcite veins and replacement bodies with silver, gold, base metals and sometimes tungsten, occur in all types of rocks. Calcite or calcite-quartz pods and lenses bearing scheelite occur in brecciated Cambrian carbonate beds. These favorable mineralized carbonate horizons often underlie shaly units (Hose and others 1976). The mineralization in the Cherry Creek district may be related to the nearby Tertiary intrusions but more probably to a hidden stock underlying the district, or possibly to an apophysis of a Tertiary intrusion.

The Cherry Creek district has many of the same geochemical characteristics as the Alunite Ridge-Deer Trail Mountain area in south central Utah, which is postulated to overlie a hidden porphyry-type mineral deposit (Cunningham and Steven, 1979). Other areas that are geochemically and geologically similar are Pine Grove, in the Wah Wah Mountains, Utah (Westra and Keith, 1981) and Red Mountain, Colorado (Wallace and others, 1978; Mutschler and others, 1981) both of which have porphyry-type mineral deposits associated with precious- and base-metal mineral deposits.

A detailed description of nonmetallic mineral resources, including known deposits, prospects, claims, deposit types, and economics is given in the G-E-M Resources Area report for Goshute Canyon (U.S. Bureau of Land Management, 1983). Descriptions of energy resources, oil and gas resources, and geothermal resources are also presented in the G-E-M report.

The Chert Creek district has many of the same geologic characteristics as the Atlantic Ridge-East Hill Mountain area in south-central Utah, which is characterized by a high topography-type mineral deposit (Kronenberg and others, 1970). Other areas that are geographically and geologically similar are Pine Grove, in the San Juan Mountains, Utah (West and Keller, 1961) and Red Mountain, Colorado (Wilcox and others, 1972). Westerman and others (1961) note of which have morphology-type mineral deposits associated with breccia- and vein-hosted mineral deposits. A detailed description of mineralogical mineral resources, including known, potential, and inferred, is given in the 2-1-1 report for the Grand Canyon (U.S. Bureau of Land Management, 1971). Descriptions of energy resources, oil and gas resources, and geothermal resources are also presented in the 2-1-1 report.



## **E. Strategic and Critical Minerals and Metals**

The Bureau of Land Management uses the following definitions of strategic and critical metals: strategic metals are those listed for stockpiling; critical metals are those for which import reliance is 50% or more.

The strategic and(or) critical metals, tungsten, silver, lead, copper, and zinc have been produced within the Cherry Creek district which includes parts of the resource survey area. One occurrence of the strategic and critical mineral fluorite is known near the survey area.

### **LAND CLASSIFICATION FOR G-E-M RESOURCES POTENTIAL**

Land classification areas are numbered starting with the number 1 in each category of resources. Metallic mineral land classification areas have the prefix M; e.g., M1-4D. Uranium and thorium areas have the prefix U. Nonmetallic mineral areas have the prefix N. Oil and gas areas have the prefix OG. Geothermal areas have the prefix G. Sodium and potassium areas have the prefix S. The favorability (number 1-4) and confidence levels (letters A-D) are defined in Table 1.

Land classifications have been made here only for the areas that encompass segments of the resource survey area, and are shown on a 1:250,000 scale.

### **A. Locatable Resources**

#### **1. Metallic minerals**

M1-4D. This classification covers the southeast corner of the Resource Survey Area (figure 8). Where several mines are present that have produced gold, silver, copper, lead and tungsten. Silver, copper and lead are strategic metals, and tungsten is a strategic and critical metal. The occurrence of productive mines, numerous prospects, and geochemical analysis give high favorability and the high confidence to this classification.



## 1. Strategic and Critical Minerals and Metals

The Bureau of Land Management uses the following definitions of strategic

and critical metals: strategic metals are those listed for stockpiling

critical metals are those for which import reliance is 50% or more.

The strategic and/or critical metals, tungsten, silver, lead, copper,

and zinc have been produced within the Cherry Creek district which includes

parts of the resource survey area. The occurrence of the strategic and

critical metals (listed in Table 1) is known near the survey area.

### LAND CLASSIFICATION FOR S-E-H RESOURCES POTENTIAL

Land classification areas are numbered starting with the number 1 in each

category of resources. Metallic mineral land classification areas have the

prefix M; e.g., M1-M5. Uranium and thorium areas have the prefix U.

Hydrocarbon potential areas have the prefix H. Oil and gas areas have the

prefix G. Geothermal areas have the prefix G. Sodium and potassium areas

have the prefix S. The feasibility (number 1-4) and confidence levels

(letters A-D) are defined in Table 1.

Land classifications have been made only for the areas that

encounter segments of the resource survey area, and are shown on a 1:250,000

scale.

#### A. Metallic Resources

##### 1. Metallic Minerals

M1-M5. This classification covers the southeast corner of the resource

survey area (Figure 1). Where several mines are present that have produced

gold, silver, copper, lead and tungsten, silver, copper and lead are

strategic metals, and tungsten is a strategic and critical metal. The

occurrence of productive mines, numerous prospects, and geophysical analysis

give high feasibility and the high confidence to this classification.

Table 1.--Bureau of Land Management classification scheme and level of confidence scheme

**Classification Scheme**

1. The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.
2. The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.
3. The geologic environment, the inferred geologic processes, and the reported mineral occurrences indicate moderate favorability for accumulation of mineral resources.
4. The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

**Level of Confidence Scheme**

- A. The available data are either insufficient and/or cannot be considered as direct evidence to support or refute the possible existence of mineral resources within the respective area.
- B. The available data provide indirect evidence to support or refute the possible existence of mineral resources.
- C. The available data provide direct evidence, but are quantitatively minimal to support or refute the possible existence of mineral resources.
- D. The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

Table 1. -- Survey of Land Management Classification Scheme and Level of

Confidence Scheme

### Classification Scheme

1. The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.
2. The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.
3. The geologic environment, the inferred geologic processes, and the reported mineral deposits indicate moderate favorability for accumulation of mineral resources.
4. The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

### Level of Confidence Scheme

- A. The available data are either insufficient and/or cannot be considered as direct evidence to suggest or refute the possible existence of mineral resources within the respective area.
- B. The available data provide indirect evidence to support or refute the possible existence of mineral resources.
- C. The available data provide direct evidence, but are quantitatively limited to support or refute the possible existence of mineral resources.
- D. The available data provide abundant direct and indirect evidence to suggest or refute the possible existence of mineral resources.



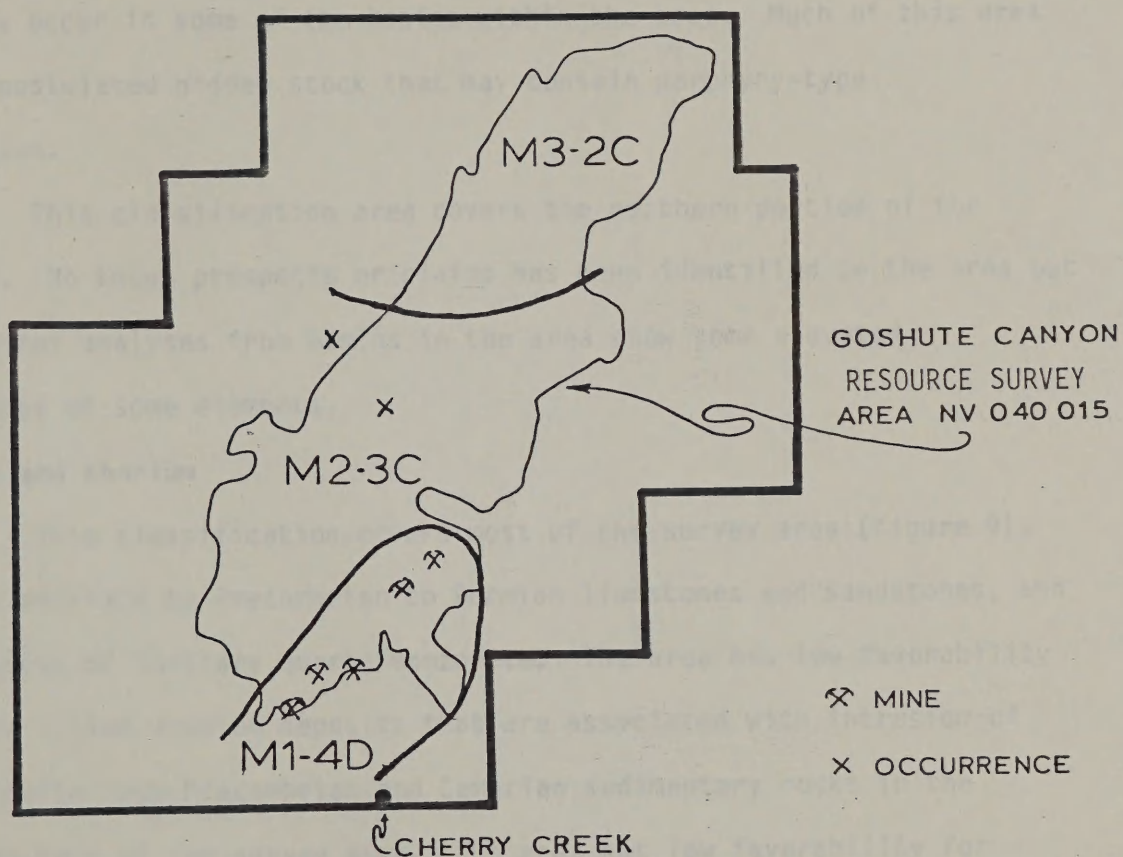


Figure 8.--Land classification for metallic mineral occurrences in the Goshute Canyon Resource Survey Area, east-central Nevada.

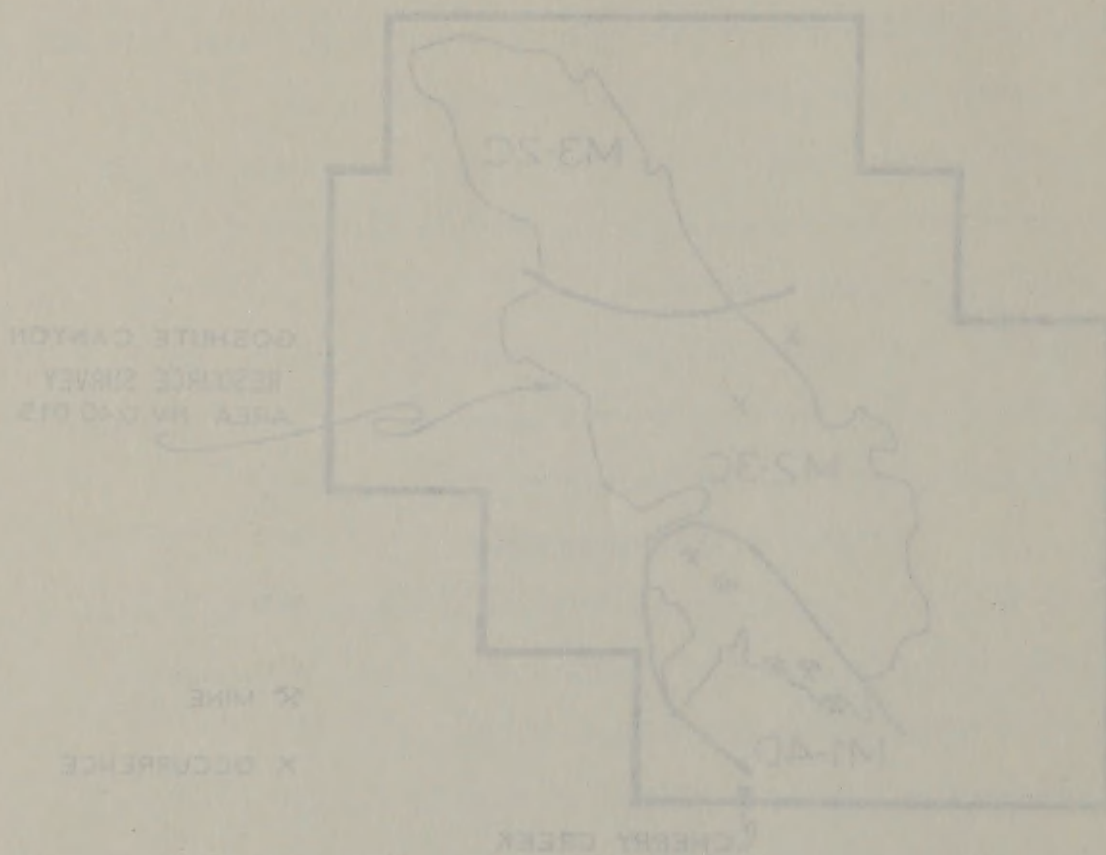


Figure 8 -- Land classification for metallic mineral occurrences in the Goshute Canyon Resource Survey Area, east-central Nevada.

M2-3C. This classification area covers part of the central portion of the survey area. Within the survey area is an area of jasperoid and other types of alteration drilled by Amselco, and just outside the survey area is the prospect shown by Hose and others (1976). The geochemical analysis suggest that as yet undiscovered vein-type precious- and base-metal mineral deposits may occur in some of the basins within the area. Much of this area overlies a postulated hidden stock that may contain porphyry-type mineralization.

M3-2C. This classification area covers the northern portion of the survey area. No known prospects or claims has been identified in the area but the geochemical analyses from basins in the area show some elevated concentrations of some elements.

## **2. Uranium and thorium**

U1-2B. This classification covers most of the survey area (figure 9). The area is overlain by Precambrian to Permian limestones and sandstones, and minor exposures of Tertiary quartz monzonite. The area has low favorability for fracture filled uranium deposits that are associated with intrusion of quartz monzonite into Precambrian and Cambrian sedimentary rocks in the southeastern part of the survey area. The area has low favorability for thorium in pegmatites associated with quartz monzonitic intrusions.

U2-2B. This land classification covers small areas on the margins of the survey area (figure 9). These areas are covered by Quaternary alluvium and have low favorability for epigenetic sandstone-type uranium deposits. The Tertiary volcanic rocks to the west of the resource area are a possible source of uranium, an element that can be leached by ground water and redeposited in the alluvium where the ground water encounters a reducing environment (i.e., organic matter).



45-50. This classification area covers part of the central portion of the survey area. Within the survey area is an area of Jasperite and other types of alteration drilled by Amstar, and just outside the survey area is the prospect shown by Moore and others (1978). The geochemical analysis suggests that as yet undiscovered vein-type precious- and base-metal mineral deposits may occur in some of the pasting within the area. Much of this area overlies a postulated hidden stock that may contain porphyry-type mineralization.

45-51. This classification area covers the northern portion of the survey area. No known prospects or claims have been identified in the area but the geochemical analysis from drilling in this area shows some elevated concentrations of some elements.

## 5. Mineral and alteration

45-52. This classification covers most of the survey area (Figure 9). The area is overlain by Franciscan to Permian limestones and sandstones, and their sequences of Tertiary overthrust nappes. The area has low favorability for fracture filled uranium deposits that are associated with intrusion of quartz monzonite into Franciscan and Cambrian sedimentary rocks in the northwestern part of the survey area. The area has low favorability for uranium in porphyries associated with quartz monzonitic intrusions.

45-53. This classification covers most of the survey area on the margins of the survey area (Figure 9). These areas are covered by Quaternary alluvium and have low favorability for epithermal precious-metal deposits. The Tertiary volcanic rocks to the west of the resource area are a possible source of uranium, as alluvium that can be leached by ground water and redeposited in the alluvium where the ground water encounters a reducing environment (i.e., organic matter).

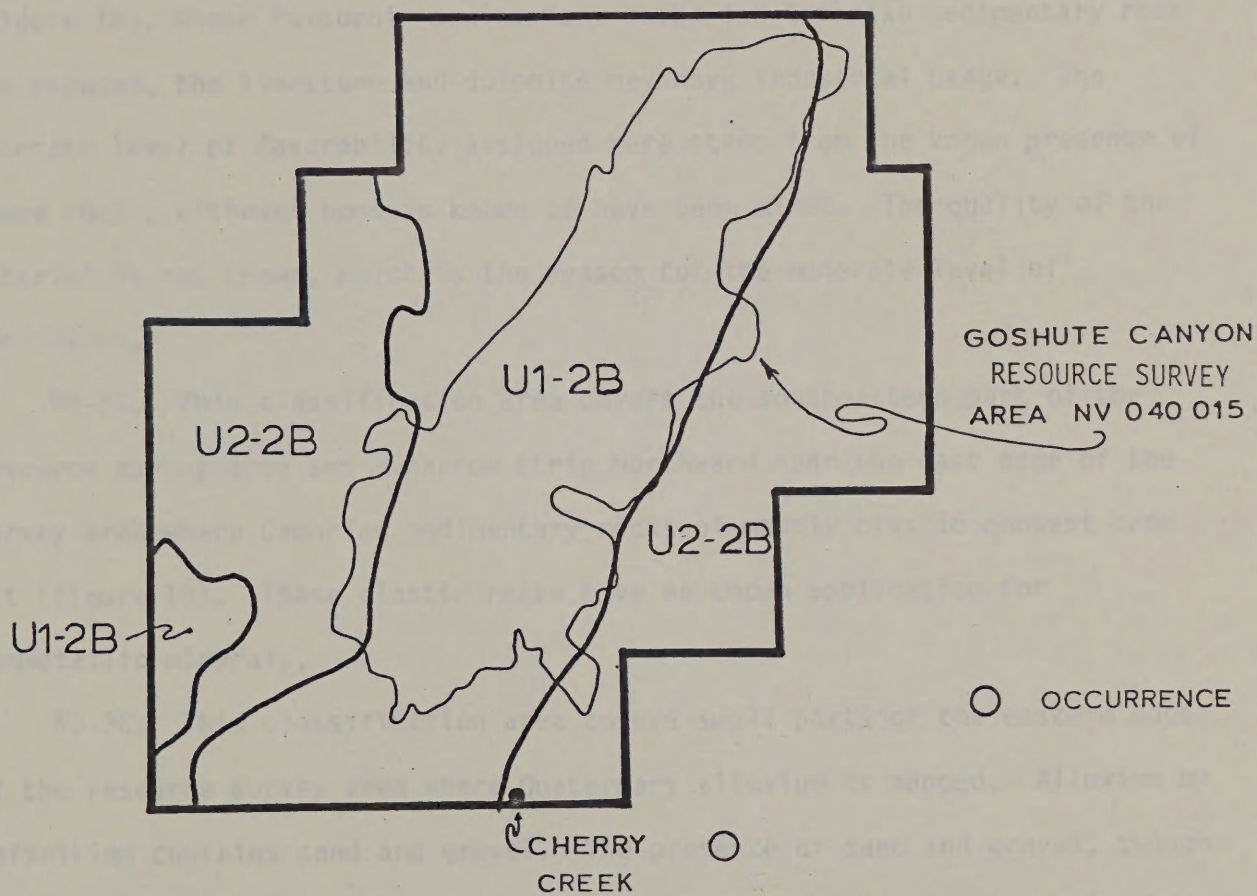
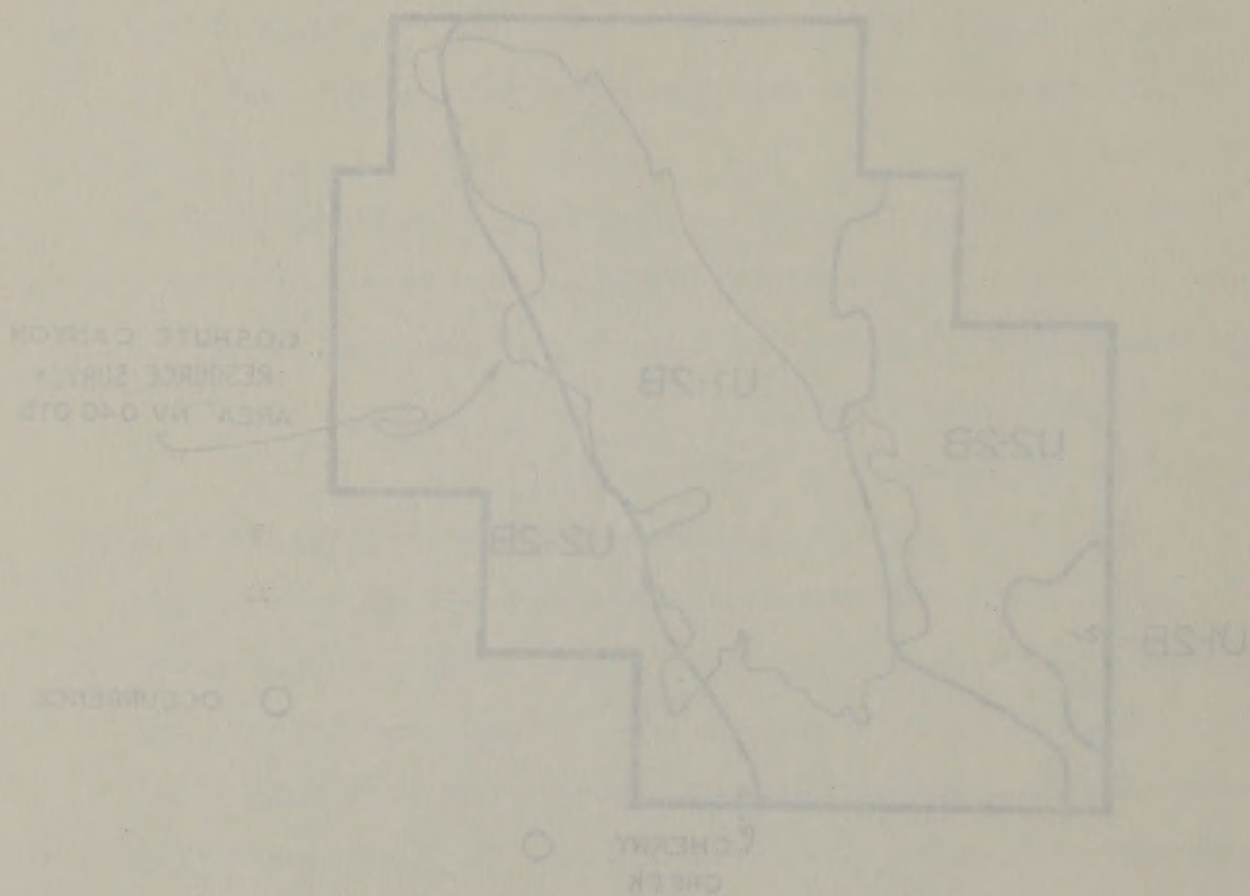


Figure 9.--Land classification for uranium and thorium occurrences  
in the Goshute Canyon Resource Survey Area, east-central Nevada.



Map 2. - 4 and classification for stream and channel occurrences in the Goshute Canyon Resource Study Area, east-central Nevada.



In alluvium to the east of the resource survey area, where pegmatitic source rocks may be present, the area has low favorability for thorium as placer concentrations.

### **3. Nonmetallic minerals**

N1-3C. This classification area covers most of the resource survey area (figure 10). Where Paleozoic sedimentary rocks and Cambrian sedimentary rock are exposed, the limestone and dolomite may have industrial usage. The moderate level of favorability assigned here stems from the known presence of these rocks, although none is known to have been mined. The quality of the material is not known, which is the reason for the moderate level of confidence.

N2-1A. This classification area covers the southeastern part of the resource survey area and a narrow strip northward near the east edge of the survey area where Cambrian sedimentary rocks of mostly clastic content crop out (figure 10). These clastic rocks have no known application for nonmetallic minerals.

N3-3C. This classification area covers small parts of the eastern edge of the resource survey area where Quaternary alluvium is mapped. Alluvium by definition contains sand and gravel. The presence of sand and gravel, though none is known to have been mined in or adjacent to the survey area, is the reason for the moderately favorable classification.

## **B. Leasable Resources**

### **1. Oil and gas**

OG1-1C. The resource survey area is underlain by Precambrian and Cambrian through Mississippian sedimentary rocks, all of which are highly faulted and generally in dipping fault blocks. This stratigraphic section is older than the producing oil reservoir source rocks in the Basin and Range

In addition to the east of the resource survey area, where metalliferous source rocks may be present, the area has low (unprofitable) thorium as glass concentrations.

### 3. Metalliferous Minerals

NI-30. This classification area covers most of the resource survey area (Figure 10). Where Paleozoic sedimentary rocks and Cambrian sedimentary rock are exposed, the limestone and dolomite may have industrial usage. The average level of favorability assigned here stems from the known presence of these rocks, although none is known to have been mined. The quality of the material is not known, which is the reason for the moderate level of confidence.

NI-12. This classification area covers the southeastern part of the resource survey area and a narrow strip northwest near the east edge of the survey area where Cambrian sedimentary rocks of mostly chert and chert conglomerate (Figure 10). These chert rocks have no known application for metalliferous minerals.

NI-8. This classification area covers small parts of the eastern edge of the resource survey area where Cambrian sedimentary rocks are exposed. Although metalliferous potential is low and gravel, the presence of sand and gravel, though none is known to have been mined in or adjacent to the survey area, is the reason for the moderately favorable classification.

### 4. Possible Resources

#### 1. Oil and Gas

NI-17. The resource survey area is underlain by Precambrian and Cambrian through Neoproterozoic sedimentary rocks, all of which are highly fractured and generally in dipping fault blocks. This stratigraphic section is often thin and containing oil reservoir source rocks in the Gasline and Range

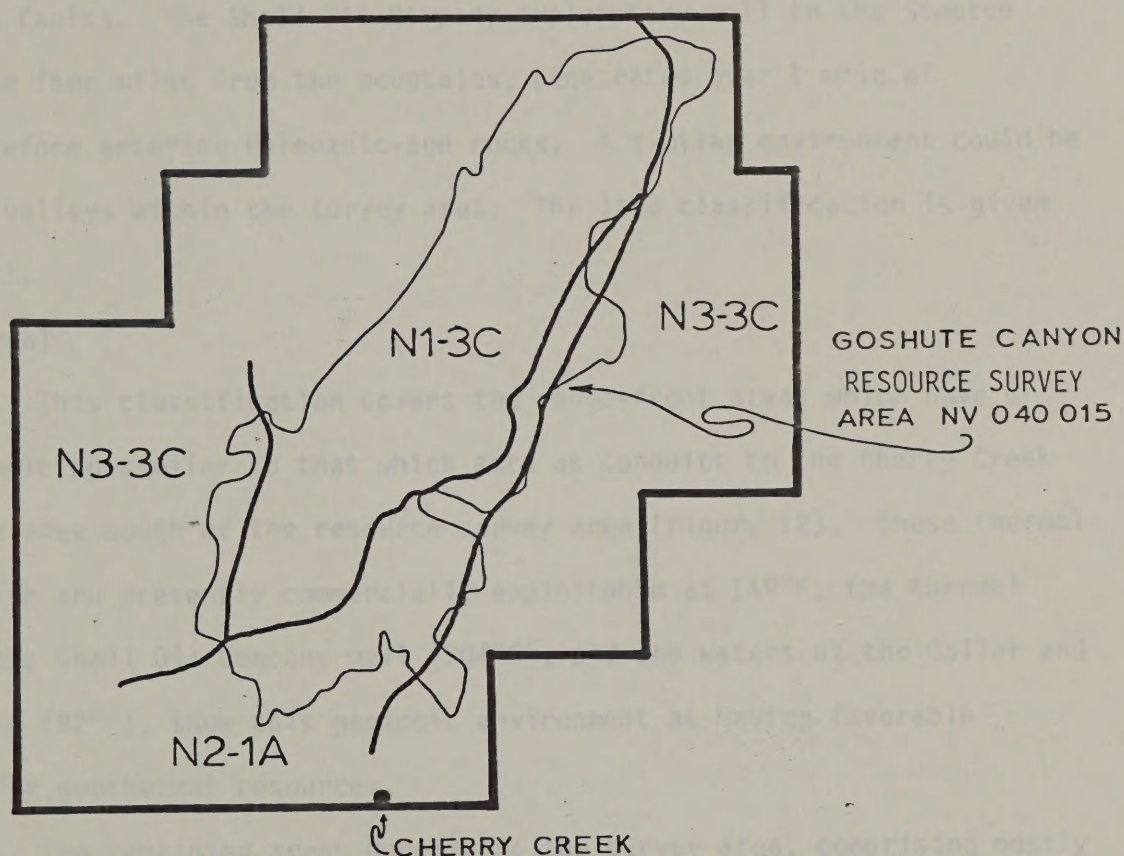


Figure 16.--Land classification for nonmetallic mineral occurrences in the Goshute Canyon Resource Survey Area, east-central Nevada.



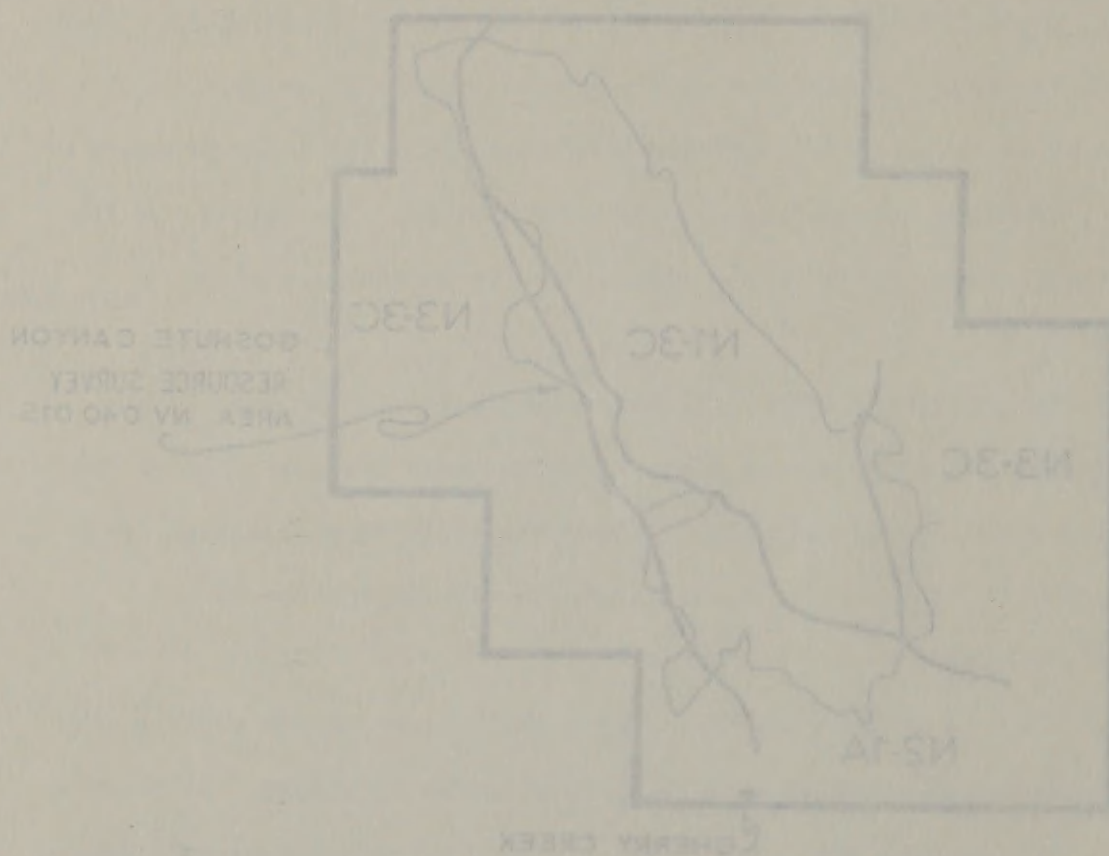


Figure 1. Land classification for nonmetallic mineral occurrences in the Goshute Canyon Resource Survey Area, east-central Nevada.

province (figure 11). therefore the area is not considered favorable for oil and gas occurrences.

OG2-2A. This classification includes those portions of the survey area which are underlain by Quaternary valley fill (figure 11). These areas may be structurally separated from the mountain ranges at reasonably shallow depth by range-front faults. The Shell Oil Company exploratory well in the Steptoe Valley, some four miles from the mountains, penetrated over 1 mile of sediments before entering Paleozoic-age rocks. A similar environment could be present in valleys within the survey area. The land classification is given in figure 11.

## **2. Geothermal**

G1-3A. This classification covers the range-front areas which have or may have faulting similar to that which acts as conduits to the Cherry Creek Hot Springs area south of the resource survey area (figure 12). These thermal waters, which are presently commercially exploitable at 149°F, the thermal waters in the Shell Oil Company well (304°F), and the waters at the Collar and Elbow Spring (92°F), show this geologic environment as having favorable potential for geothermal resources.

G2-2A. The remaining areas underlying the survey area, comprising mostly the faulted Cherry Creek Range and a small valley portion in Butte Valley, are in close enough proximity to the favorable Steptoe Valley thermal area to have at least low potential for geothermal resources (figure 12).

## **3. Sodium and potassium**

S1-1D. The survey area is not known to have any potential for sodium and potassium, and is classified in its entirety as S1-1D.

## **C. Saleable Resources**

Saleable resources have been considered in connection with nonmetallic minerals.

... (Figure 11) ... the area is not considered favorable for oil and gas occurrences.

005-2A. This classification includes those portions of the survey area which are underlain by Quaternary alluvial (Figure 11). These areas may be structurally separated from the main range at reasonably shallow depth by range-front faults. The 2001 oil company exploratory well in the Stenoos Valley, some four miles from the mountains, penetrated over 1 mile of sediment before entering Paleozoic-age rocks. A similar environment could be present in valleys within the survey area. The land classification is given in Figure 11.

### 5. Geothermal

51-2A. This classification covers the range-front areas which have or may have faults similar to that which acts as conduits to the Cherry Creek hot spring area south of the resource survey area (Figure 12). These thermal waters, which are presently commercially exploitable at 149°F, the thermal water in the 2001 oil company well (204°F), and the waters at the Collier and Elbow Spring (92°F), show this geologic environment as having favorable potential for geothermal resources.

52-51. The remaining areas underlying the survey area, consisting mostly of the limited Cherry Creek Range and a small valley portion in Butte Valley, are in close enough proximity to the favorable Stenoos Valley thermal area to have at least low potential for geothermal resources (Figure 12).

### 3. Sodium and potassium

51-10. The survey area is not known to have any potential for sodium and potassium, and is classified in this category as 51-10.

### C. Saline Resources

Saline resources have been considered in connection with geothermal



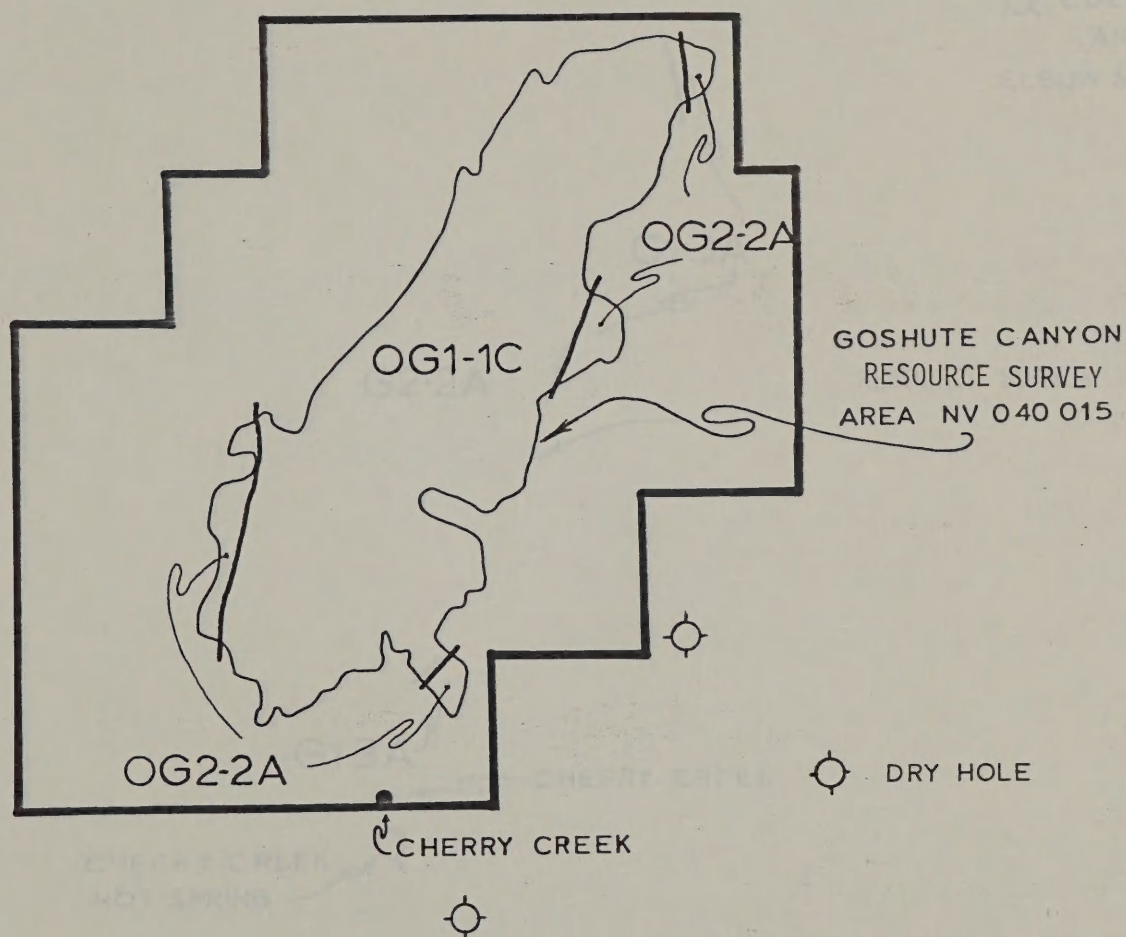


Figure 11.--Land classification for oil and gas leasable resources  
in the Goshute Canyon Resource Survey Area, east-central Nevada.

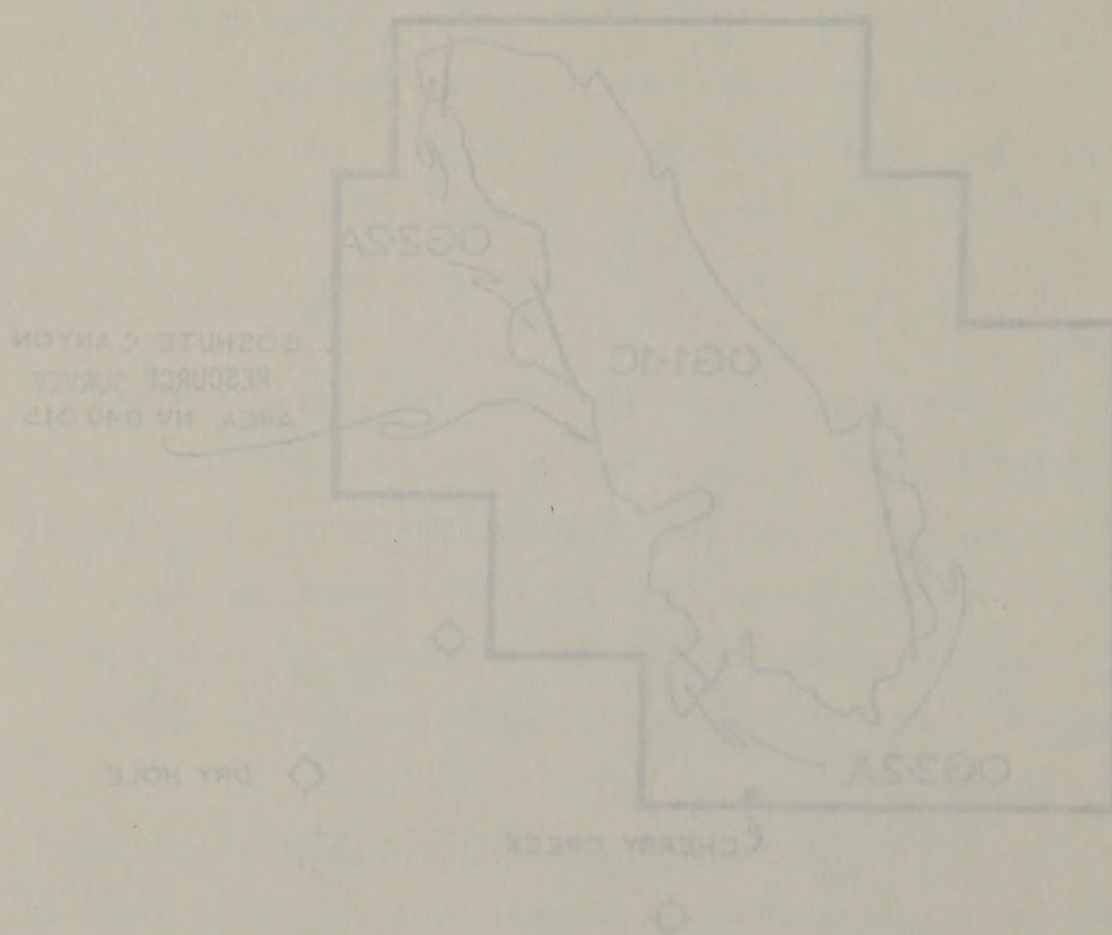


Figure 11. -- Land Classification for oil and gas feasible resources in the Goshute Indian Reservation, Area, east-central Nevada.

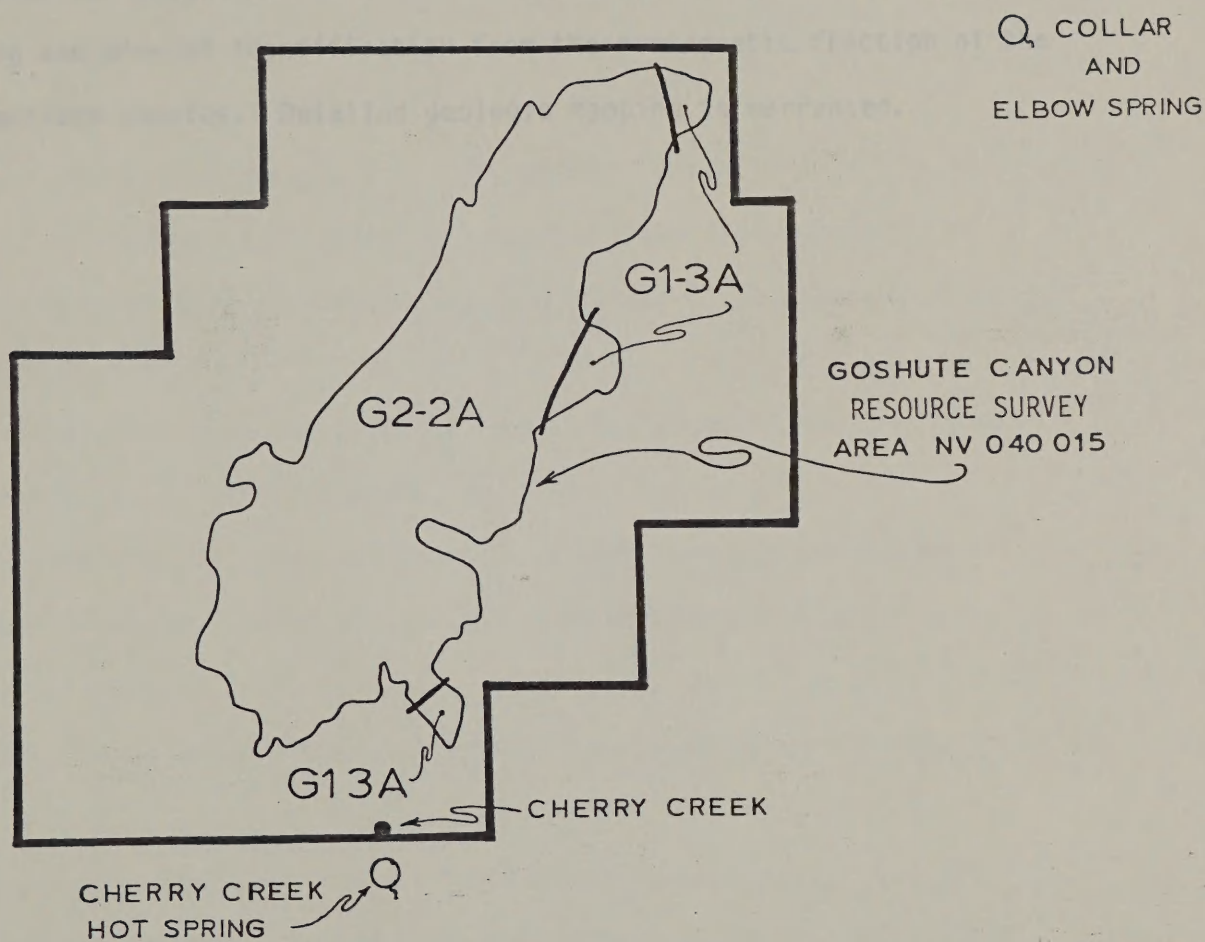
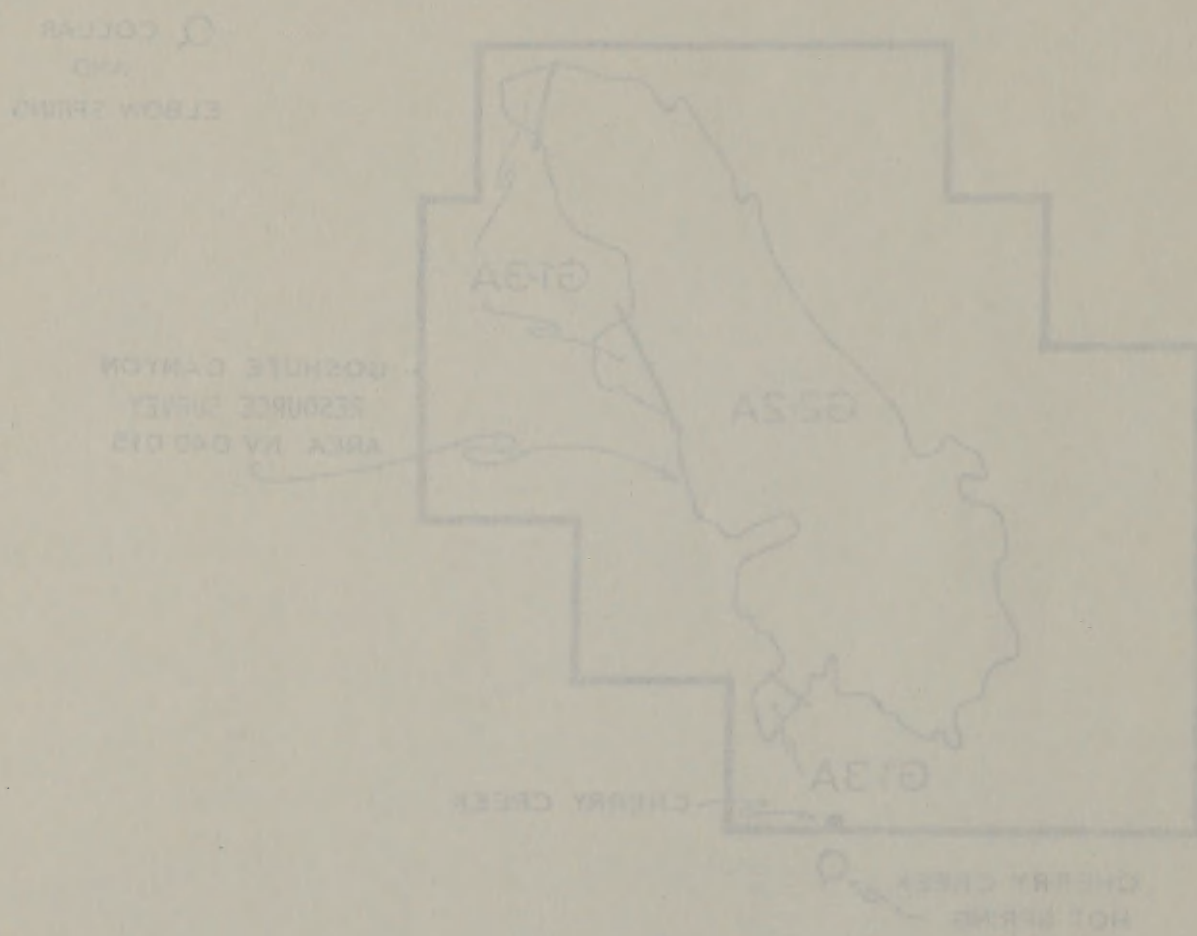


Figure 12.--Land classification for geothermal leasable resources in the Goshute Canyon Resource Survey Area, east-central Nevada.



Figure 12.--Land classification for potential livestock resources in the Goshute Canyon Resource Survey Area, east-central Nevada



## RECOMMENDATIONS FOR ADDITIONAL WORK

The geochemical data and geological evidence suggest that the Resource Survey Area may contain as yet undiscovered vein-type mineral deposits and that a porphyry-type mineral deposit may underlie the Cherry Creek district. Further geochemical work could include more detailed stream-sediment sampling, rock sampling and mineral identification from the nonmagnetic fraction of the panned concentrate samples. Detailed geologic mapping is warranted.

Grimes, B. J., and Warrick, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for quantitative analysis of geological materials, U.S. Geological Survey Circular 551, 8 p.

Hess, W. H., 1956, Notes on operation of Frantz Isodynamic Separator, pamphlet published by S. S. Frantz Company, Inc., 8 p.

Hess, W. H., Hesse, R. C., Jr., and Smith, R., 1976, Geology and mineral resources of White Pine County, Nevada, Nevada Bureau of Mines and Geology Bulletin 89.

Kirkham, C. J., 1971, Dana's Manual of Mineralogy, John Wiley and Son, Inc., 578 p.

McAndrew, J., 1967, Calibration of a Frantz Isodynamic Separator and its application to mineral separation, Australia Institute of Mining and Metallurgy Proceedings, no. 125, p. 69-73.

Mutchie, J. W., and Grimes, B. J., 1977, Analytical procedures of one-stage, order ten quantitative spectrographic analysis, U.S. Geological Survey Circular 733, 25 p.

Mutchie, J. W., Wright, T. G., Livingston, S., and Skene, J. W., 1978, Granite-mylonite systems, Economic Geology, v. 73, p. 874-887.

# RECOMMENDATIONS FOR ADDITIONAL WORK

The geochronological data and geological evidence suggest that the extensive  
Zoned Area may contain as yet undiscovered vein-type mineral deposits and  
that a porphyry-type mineral deposit may underlie the Cherry Creek district.  
Further geochronological work should include more detailed stream-sediment sampling,  
rock sampling and mineral identification from the nonmagmatic fraction of the  
granite concentrate samples. Detailed geologic mapping is warranted.



#### REFERENCES CITED

- Cunningham, C. G., and Steven, T. A., 1979, Geologic map of the Deer Trail Mountain-Deer Trail Ridge mining area, west-central Utah: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-1230, scale 1:24,000.
- Flinter, B. H., 1959, The magnetic separation of some alluvial minerals in Malaya: *American Mineralogist*, v. 44, p. 739-751.
- Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.
- Hess, H. H., 1956, Notes on operation of Frantz Isodynamic Separator, pamphlet published by S. G. Frantz Company, Inc., 8 p.
- Hose, R. K., Blake, M. C., Jr., and Smith, R., 1976, Geology and mineral resources of White Pine County, Nevada: Nevada Bureau of Mines and Geology Bulletin 85.
- Hurlbut, C. S., 1971, Dana's Manual of Mineralogy, John Wiley and Son, Inc., 579 p.
- McAndrew, J., 1957, Calibration of a Frantz Isodynamic Separator and its application to mineral separation: Australia Institute of Mining and Metallurgy Proceedings, no. 181, p. 59-73.
- Motooka, J. M., and Grimes, D. J., 1977, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geological Survey Circular 738, 25 p.
- Mutschler, F. E., Wright, E. G., Ludington, S., and Abbott, J. T., 1981, Granite molybdenum systems: *Economic Geology*, v. 76, p. 874-897.



- Nickel, E. H., 1968, Structural stability of minerals with the pyrite, marcasite, arsenopyrite, and lollingite structures: Canadian Mineralogist, v. 9, p. 311-321.
- \_\_\_\_\_ 1969, The application of ligand-field concepts to an understanding of the structural stabilities and solid solution limits of sulphides and related minerals: Chemical Geology, v. 5, p. 233-241.
- Rosenblum, S., 1958, Magnetic susceptibilities of minerals in the Frantz Isodynamic Separator: American Mineralogist, v. 43, p. 170-173.
- U.S. Bureau of Land Management, 1983, Goshute Canyon G-E-M Resources Area (GRA No. NV-03) Technical Report (WSA NV 040-015), Contract YA-554-RFP2-1054, Prepared by Great Basin Joint Venture, 251 Ralston Street, Reno, Nevada 89503, January 11, 1983, 48 p.
- Wallace, S. R., Mackenzi, W. B., Blair, R. G., and Muncaster, N. K., 1978, Geology of the Urad and Henderson molybdenite deposits, Clear Creek County, Colorado, with a section on a comparison of these deposits with those at Climax, Colorado: Economic Geology, v. 73, p. 325-368.
- Westra, G., and Keith, S. B., 1981, Classification and genesis of stockwork molybdenum deposits: Economic Geology, v. 76, p. 844-873.



Wicks, E. H., 1968, Structural stability of minerals with the pyrite, arsenite, arsenosulfite, and tellurite structures. *Canadian Mineralogist*, v. 6, p. 311-321.

\_\_\_\_\_, 1969, The application of liquid-field concepts to an understanding of the structural stability and solid solution limits of sulphides and related minerals. *Chemical Geology*, v. 2, p. 233-247.

Wernicke, S., 1968, Regional tectonics of minerals in the Pacific. *Isodynamic Diagrams*, American Mineralogist, v. 53, p. 130-131.

U.S. Bureau of Land Management, 1963, Boulder Canyon G-2-M Resource Area (2A). No. W-03 Technical Report (NSA W-03-01), Contract YA-554-WF2-1024, prepared by Great Basin Joint Venture, 251 Patton Street, Reno, Nevada.

Wernicke, S., 1965, January 11, 1965, 48 p.

Wernicke, S., 1968, W. B., R. L., and H. L., 1968, Geology of the Wood and Henderson polymorphic deposits, Elmer Creek County, Colorado, with a section on a comparison of these deposits with those at Elmer, Colorado. *Economic Geology*, v. 63, p. 325-348.

Wernicke, S., and Keith, S. B., 1961, Classification and genesis of rockwork polymorphic deposits. *Economic Geology*, v. 56, p. 844-873.

Appendix 1.--Analytical results for the minus-80-mesh fraction of the stream sediment samples from the Goshute Canyon  
Wilderness Study Area, east-central Nevada.

Sample	LATITUDE	LONGITUDE	Fe %	Mg %	Ca %	Ti %	Mn ppm	Zn ppm	Ba ppm	Be ppm	Co ppm	Cr ppm	Cu ppm
01	39 55 37	114 57 0	2.0	2.0	3.0	.20	1,000	100	500	3	10	50	30
02	39 54 39	114 53 28	5.0	.5	.5	.30	1,000	70	700	5	15	50	70
03B002	39 54 55	114 53 9	2.0	.5	.7	.20	700	100	700	3	10	50	50
04S003	39 54 56	114 53 10	2.0	.5	.7	.20	1,000	70	700	3	10	70	70
04ADP	39 54 56	114 53 10	3.0	.5	1.0	.50	1,000	150	500	5	15	30	70
05	39 55 57	114 53 55	2.0	2.0	10.0	.50	700	70	200	1	15	50	70
06	39 56 21	114 52 31	2.0	2.0	3.0	.50	1,000	100	500	2	15	50	150
07	39 57 35	114 52 39	2.0	1.0	5.0	.50	700	70	300	1	10	50	100
08	39 56 27	114 50 59	2.0	2.0	5.0	.50	700	100	300	2	15	50	100
09	39 59 40	114 52 3	1.0	2.0	10.0	.10	1,000	150	300	3	5	50	20
10B009	39 59 42	114 52 8	2.0	5.0	7.0	.20	500	70	200	1	10	50	150
11S010	39 59 46	114 52 10	2.0	3.0	5.0	.20	500	100	200	1	10	50	100
12	40 0 56	114 46 53	1.0	2.0	5.0	.15	700	100	500	2	10	100	50
13	40 0 22	114 46 18	2.0	3.0	7.0	.20	500	70	500	1	10	70	70
14	40 0 32	114 47 2	1.0	2.0	3.0	.20	500	70	200	2	10	70	100
15	40 0 33	114 49 33	2.0	3.0	10.0	.20	500	70	500	2	10	50	100
16	39 56 1	114 56 20	3.0	2.0	5.0	.50	700	100	700	2	10	50	100
17B016	39 56 33	114 56 12	2.0	1.0	2.0	.20	1,000	150	500	3	10	50	50
18S017	39 56 34	114 56 11	2.0	2.0	3.0	.20	1,000	150	500	3	10	70	50
18ADP	39 56 34	114 56 11	3.0	2.0	5.0	.30	1,000	200	500	7	15	50	50
19	39 56 23	114 56 23	1.0	5.0	5.0	.10	500	70	200	1	10	70	70
20	39 56 10	114 55 20	1.0	2.0	5.0	.10	700	70	200	2	10	70	70
21	39 56 34	114 54 10	2.0	1.0	5.0	.20	700	100	500	2	15	100	70
22	39 57 5	114 54 17	2.0	2.0	10.0	.20	1,000	100	500	3	10	70	70
23	39 57 27	114 55 24	1.0	5.0	5.0	.15	700	100	200	2	10	70	70
24	39 55 49	114 51 33	2.0	.5	.7	.20	1,000	100	700	3	10	50	70
25	39 55 5	114 50 30	1.0	2.0	10.0	.20	1,000	70	500	3	10	50	20
26	39 57 9	114 51 34	1.0	.7	10.0	.20	1,000	100	700	3	15	50	70
27	39 59 16	114 52 59	1.0	2.0	1.0	.10	700	100	500	2	10	100	20
28	40 0 38	114 54 15	1.0	2.0	5.0	.20	700	150	500	3	10	50	20
29B028	40 0 44	114 54 32	1.0	2.0	10.0	.20	700	100	500	3	10	70	30
30S029	40 0 46	114 54 30	1.0	5.0	10.0	.10	700	100	200	2	10	50	15
31	40 0 46	114 54 30	1.0	5.0	10.0	.10	500	150	300	2	10	50	10
32	40 1 3	114 53 35	1.0	2.0	10.0	.10	700	70	150	1	10	50	10
33	40 2 21	114 52 38	2.0	.5	.5	.20	700	150	500	3	15	50	10
34	40 1 29	114 53 15	1.0	.5	.7	.20	700	100	700	2	10	100	70
35	40 1 46	114 51 50	1.0	2.0	10.0	.20	700	70	200	2	10	50	15
36	40 2 29	114 51 40	1.0	3.0	5.0	.20	700	100	500	3	10	70	50
37	40 2 49	114 50 15	1.0	1.0	10.0	.20	1,000	150	500	3	10	70	50
38	40 2 27	114 51 29	2.0	.5	.3	.20	500	150	500	5	15	50	50
39	40 3 54	114 50 9	1.0	5.0	10.0	.20	700	100	500	3	10	70	30
40	40 3 33	114 49 7	1.0	2.0	5.0	.20	700	150	500	2	10	50	50
41	40 4 20	114 47 56	2.0	1.0	2.0	.20	1,000	100	500	3	15	70	50
42	39 58 5	114 51 50	2.0	1.0	5.0	.20	700	100	500	3	15	50	50
43	40 3 5	114 48 8	1.0	1.0	5.0	.20	1,000	100	700	3	15	50	50





Appendix 1.--Analytical results for the minus-80-mesh fraction of the stream sediment samples from the Goshute Canyon  
Wilderness Study Area, east-central Nevada.

Sample	La ppm	Ni ppm	Pb ppm	Sc ppm	Sr ppm	V ppm	Y ppm	Zr ppm
01	30	20	70	7	200	70	10	100
02	100	15	150	10	300	100	30	300
03B002	50	20	70	10	200	100	10	200
04S003	50	20	100	10	200	100	30	200
04A0P	50	50	70	7	200	100	30	300
05	30	30	70	10	200	70	15	100
06	50	30	100	10	200	100	20	300
07	30	30	70	10	200	70	15	200
08	20	50	70	10	100	100	20	200
09	30	30	70	7	200	100	20	100
10B009	20	30	70	50	100	100	10	150
11S010	20	50	70	50	200	100	20	150
12	30	20	70	10	200	70	20	100
13	20	30	70	50	200	70	15	100
14	30	30	70	50	100	100	10	200
15	20	30	70	10	200	50	15	150
16	50	30	70	10	200	100	30	200
17B016	50	20	70	10	200	100	30	150
18S017	30	20	70	10	200	100	20	150
18A0P	30	30	50	10	200	100	10	300
19	5	10	70	5	200	30	15	30
20	5	10	70	5	100	50	15	100
21	30	50	70	15	300	70	30	150
22	20	20	100	10	200	100	20	100
23	10	10	70	7	200	50	20	10
24	50	15	70	15	300	100	10	100
25	30	10	30	7	200	100	30	150
26	30	30	70	10	500	100	30	100
27	5	20	70	10	200	70	30	150
28	30	20	70	7	200	70	20	150
29B028	5	30	70	10	200	70	20	150
30S029	5	30	70	5	200	50	15	10
30A0P	30	30	70	7	100	70	10	100
31	30	15	50	5	200	30	15	10
32	20	50	20	10	200	100	30	100
33	20	30	50	10	200	70	30	100
34	5	30	50	5	200	100	20	150
35	20	30	70	10	200	100	10	200
36	10	15	70	7	200	100	20	150
37	10	10	50	10	200	100	10	100
38	30	30	100	10	200	100	10	150
39	30	20	70	7	200	50	10	150
40	30	20	70	10	200	70	10	200
41	30	20	70	15	200	100	30	100
42	5	10	70	10	300	100	30	200



Appendix 1.--Analytical results for the minus-60-mesh fraction of the stream sediment samples from the Goshute Canyon  
Wilderness Study Area, east-central Nevada.--continued

Sample	LATITUDE		LONGITUDE		Fe %	Mg %	Ca %	Ti %	Mn ppm	B ppm	Ba ppm	Be ppm	Co ppm	Cr ppm	Cu ppm
43	40	2 11	114	49 46	.7	2.0	20.0	.10	500	30	200	1	5	50	10
44	40	2 37	114	48 22	1.0	2.0	2.0	.10	700	100	500	2	10	100	50
45	40	4 50	114	43 2	1.0	2.0	5.0	.15	700	150	500	1	10	70	50
46SD45	40	4 53	114	47 59	1.0	2.0	10.0	.20	700	70	300	3	10	50	30
47SD46	40	4 57	114	48 2	1.0	5.0	10.0	.20	700	100	300	2	10	50	20
47ADP	40	4 57	114	48 2	1.0	5.0	10.0	.20	700	150	300	3	10	50	30
48	40	6 38	114	47 56	1.0	1.0	3.0	.20	700	150	500	2	10	70	50
49	40	5 8	114	46 45	2.0	1.0	5.0	.20	700	100	500	3	10	50	70
50	40	2 17	114	48 19	1.0	1.0	10.0	.20	700	100	700	3	10	100	70



1902 1903

1904 1905

1906 1907

1908 1909

1910 1911

1912 1913

1914 1915

1916 1917

1918 1919

1920 1921

1922 1923

1924 1925

1926 1927

1928 1929

1930 1931

1932 1933

1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933

Appendix 1.--Analytical results for the minus-80-mesh fraction of the stream sediment samples from the Goshute Canyon  
Wilderness Study Area, east-central Nevada.--continued

Sample	La ppm	Ni ppm	Pb ppm	Sc ppm	Sr ppm	V ppm	Y ppm	Zr ppm
43	N	10	50	5	200	30	15	70
44	20	20	100	10	200	70	30	200
45	30	20	70	7	200	70	30	200
46u045	N	30	70	10	200	70	20	100
47SD46	20	30	70	10	200	100	20	100
47ADP	30	20	50	7	150	70	20	200
48	30	30	70	10	200	70	20	150
49	30	20	70	10	200	100	20	200
50	N	30	70	10	200	70	30	200

1000 1000 1000  
 2000 2000 2000  
 3000 3000 3000  
 4000 4000 4000  
 5000 5000 5000  
 6000 6000 6000  
 7000 7000 7000  
 8000 8000 8000  
 9000 9000 9000  
 10000 10000 10000



Appendix 1--Analytical results for the nonmagnetic fraction of the panned concentrate samples from the Goshute Canyon Wilderness Study Area, east-central Nevada.

Sample	LATITUDE	LONGITUD	Fe %	Mg %	Ca %	Ti %	Mn ppm	Ag ppm	Au ppm	B ppm	Ba ppm	Be ppm	Bi ppm
01	39 55 37	114 57 0	2.0	2.0	5	.50	700	N	N	70	700	5	N
02	39 54 39	114 53 28	1.5	.2	2	>2.00	300	N	N	50	700	5	150
03BD02	39 54 55	114 53 9	2.0	.5	5	>2.00	300	N	N	70	1,000	5	1,000
04SD03	39 54 56	114 53 10	2.0	.7	2	>2.00	300	N	N	70	1,000	2	150
04ADP	39 54 56	114 53 10	2.0	.5	2	>2.00	500	N	N	150	1,000	2	100
05	39 55 57	114 53 55	2.0	.7	10	2.00	200	700	30	20	>10,000	2	N
06	39 56 21	114 52 31	2.0	1.0	7	>2.00	500	N	N	150	7,000	5	N
07	39 57 35	114 52 39	5.0	5.0	50	.50	500	100	N	50	20,000	5	100
08	39 58 27	114 50 59	5.0	1.5	50	.50	700	N	N	70	>10,000	2	N
09	39 59 40	114 52 3	5.0	5.0	20	.50	500	N	N	100	>10,000	2	N
10BD09	39 59 42	114 52 8	2.0	5.0	10	.20	200	N	N	70	>10,000	<2	N
11SD10	39 59 46	114 52 10	2.0	5.0	20	.20	300	N	N	50	>10,000	2	N
11ADP	39 59 46	114 52 10	2.0	5.0	20	.50	300	N	N	150	>10,000	2	N
13	40 6 52	114 46 18	2.0	7.0	20	.50	300	N	N	50	700	2	50
14	40 4 52	114 47 2	2.0	5.0	20	.50	300	N	N	50	7,000	2	N
15	40 1 43	114 48 33	5.0	2.0	20	.30	500	15	N	30	>10,000	N	N
16	39 56 1	114 56 20	2.0	1.5	15	.70	200	N	N	30	>10,000	2	N
17BD16	39 56 53	114 56 12	2.0	2.0	30	.20	500	N	N	50	>10,000	2	N
18SD17	39 56 54	114 56 11	1.5	2.0	20	.15	500	N	N	200	>10,000	2	<20
19	39 57 56	114 56 23	.7	20.0	20	.30	500	N	N	20	1,000	N	N
21	39 55 54	114 54 10	1.5	10.0	20	2.00	500	N	N	20	500	N	N
22	39 57 8	114 54 17	1.5	20.0	20	.50	500	70	N	20	>10,000	N	N
23	39 59 27	114 55 24	1.0	20.0	20	.50	300	N	N	20	2,000	N	N
24	39 56 49	114 51 33	2.0	5.0	10	>2.00	700	N	N	70	700	2	N
25	39 59 5	114 50 30	.7	10.0	20	.50	200	N	N	20	1,500	N	N
27	39 59 16	114 52 59	1.5	20.0	30	.50	500	7	30	20	700	N	N
28	40 0 38	114 54 15	.5	10.0	20	.20	200	N	N	20	>10,000	N	N
30SD29	40 0 46	114 54 30	1.0	10.0	20	.20	200	N	N	20	7,000	N	N
30ADP	40 0 46	114 54 30	.5	10.0	20	.10	200	N	N	50	>10,000	N	N
31	40 1 9	114 53 35	1.0	20.0	20	.20	500	5	30	20	10,000	N	N
34	40 1 46	114 51 50	1.0	10.0	20	.50	200	N	N	20	>10,000	N	N
38	40 3 54	114 50 9	1.5	20.0	20	.20	500	N	N	20	700	N	N
41	39 58 3	114 51 50	2.0	5.0	20	2.00	300	7	N	70	1,000	2	N
42	40 3 5	114 48 8	2.0	10.0	20	1.00	700	N	N	30	1,500	<2	N
44	40 2 39	114 48 22	1.0	10.0	20	.20	200	5	N	20	1,500	N	N
45	40 4 50	114 48 2	1.0	10.0	20	.20	200	N	N	<20	1,500	N	N
46BD45	40 3 53	114 47 59	1.0	10.0	20	.50	200	N	N	20	1,000	N	N
47SD46	40 4 57	114 48 2	1.0	10.0	20	.10	200	N	N	20	1,500	N	N
47ADP	40 4 57	114 48 2	1.0	10.0	20	.10	200	N	N	50	1,500	N	N



Appendix 2--Analytical results for the nonmagnetic fraction of the panned concentrate samples from the Goshute Canyon  
wilderness Study Area, east-central Nevada.

Sample	Co ppm	Cr ppm	Cu ppm	La ppm	Mo ppm	Nb ppm	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sn ppm	Sr ppm	V ppm
01	N	70	30	100	N	50	10	50	500	10	N	500	50
02	N	200	200	700	30	2,000	10	7,000	N	70	300	200	500
03BD02	N	500	70	700	N	1,000	10	5,000	N	70	150	200	200
04SD03	N	500	70	300	N	1,000	10	150	N	10	150	200	150
04ADP	N	300	150	200	N	300	10	20	N	70	70	500	200
05	10	150	200	500	50	50	10	10,000	1,000	10	500	5,000	100
06	N	700	70	300	N	300	10	150	N	70	N	500	150
07	N	150	150	200	N	N	20	50,000	N	20	3,000	2,000	150
08	70	70	50	700	N	N	70	200	N	10	N	5,000	50
09	70	50	30	300	N	N	50	200	N	10	N	1,000	70
10BD09	N	70	20	N	N	N	10	20	N	10	N	2,000	100
11SD10	N	100	20	150	N	N	10	100	700	10	N	1,000	50
11ADP	20	100	30	200	N	N	70	70	700	10	N	1,000	100
13	N	100	20	100	N	50	10	150	N	10	N	200	100
14	N	70	70	100	N	N	10	50	N	10	N	700	50
15	70	150	50	300	N	N	50	500	N	10	N	3,000	50
16	N	200	30	1,500	N	100	10	300	N	10	N	5,000	150
17BD16	N	700	30	700	N	N	10	70	N	10	N	3,000	200
18SD17	N	150	20	500	N	N	10	500	N	10	20	2,000	70
19	N	N	10	50	N	N	10	20	200	30	N	N	20
21	10	70	10	70	N	N	10	1,000	N	20	300	200	70
22	N	N	10	50	N	N	10	2,000	700	10	150	1,000	50
23	N	N	10	50	N	N	10	200	N	20	N	N	20
24	N	300	50	200	N	150	10	150	N	30	500	200	150
25	N	N	10	50	N	N	10	50	N	20	N	200	20
27	N	20	10	50	N	N	10	20	N	20	N	500	20
28	N	N	10	N	N	N	10	N	N	10	N	1,000	20
31SD29	N	N	20	N	N	N	10	20	N	10	N	200	20
30ADP	N	150	30	N	N	N	10	50	N	10	N	200	20
31	N	N	10	N	N	N	10	N	N	20	N	200	20
34	N	N	10	50	N	N	10	50	N	10	N	2,000	20
35	N	N	10	N	N	N	10	20	N	N	N	N	20
41	10	N	20	200	N	70	10	70	N	10	N	500	70
42	N	70	30	300	N	N	10	100	N	20	N	1,000	70
43	N	N	10	50	N	N	10	70	N	10	N	100	20
44	N	N	10	50	N	N	10	20	N	N	N	200	20
45	N	N	20	50	N	N	10	70	N	20	N	200	20
46	N	N	30	N	N	N	10	20	N	N	N	200	20
47	N	70	20	N	N	N	10	20	N	10	N	200	20





Appendix 2--Analytical results for the nonmagnetic fraction of the canned concentrate samples from the Goshute Canyon  
Wilderness Study Area, east-central Nevada.

Sample	W ppm	Y ppm	Zn ppm	Zr ppm
01	N	100	N	>2,000
02	5,000	700	700	>2,000
036002	5,000	700	N	>2,000
045003	5,000	500	N	>2,000
04ADP	2,000	500	N	>2,000
05	20,000	200	5,000	>2,000
06	1,000	500	N	>2,000
07	N	300	5,000	>5,000
08	100	700	700	>2,000
09	500	500	N	>2,000
10H009	N	50	N	1,500
11S010	N	150	500	1,500
11ADP	N	150	700	2,000
13	200	150	N	>2,000
14	N	150	N	>2,000
15	1,000	300	N	>2,000
16	2,000	500	2,000	>2,000
17H016	N	700	N	2,000
18S017	N	200	N	>2,000
19	N	100	N	>2,000
21	3,000	100	N	>2,000
22	150	100	N	>2,000
23	N	200	N	>2,000
24	N	700	N	>2,000
25	N	100	N	>2,000
27	N	100	N	>2,000
28	500	150	N	>2,000
30S029	N	50	N	>2,000
30ADP	N	20	N	>2,000
31	N	70	N	>2,000
34	N	300	N	>2,000
35	N	20	N	2,000
36	N	300	N	>2,000
37	N	300	N	>2,000
38	N	70	N	>2,000
39	N	50	N	>2,000
40B045	N	100	N	>2,000
47S046	N	20	N	2,000
47ADP	N	30	N	2,000

